issa | INTERNATIONAL SOCIAL SECURITY ASSOCIATION

Technical Report 04

Demographic and economic assumptions used in actuarial valuations of social security and pension schemes

Finland, France, Italy, Japan, Québec, Sweden, Switzerland, United Kingdom, United States

François Boulanger
Actuary
Charles Cossette
Actuary
and
Gilbert Ouellet
Economist
The Quebec Pensions Board
Canada

Demographic and economic assumptions used in actuarial valuations of social security and pension schemes

Finland, France, Italy, Japan, Québec, Sweden, Switzerland, United Kingdom, United States

François Boulanger
Actuary
Charles Cossette
Actuary
and
Gilbert Ouellet
Economist
The Quebec Pensions Board
Canada

Technical Commission on Statistical, Actuarial and Financial Studies
World Social Security Forum, Moscow, 10-15 September 2007

First published 2007.

Summary

In the decades to come, Quebec, like most industrialized countries, will experience an ageing of the population, caused by a drop in birth rates and a rise in life expectancy. Population dynamics such as these will have a significant impact on the characteristics of the economically active population and on the future income and disbursements of the public pension plan.

During the preparation of the Actuarial Report of the Quebec Pension Plan as at 31 December 2006, actuaries at the Quebec Pensions Board carried out a study comparing assumptions and projections used for the Québec scheme with those of social security schemes in eight countries. For purposes of a comparative analysis, the Regie conducted a survey, which was supported by the International Social Security Association. Persons[1] *responsible for the actuarial valuation of social security schemes of these countries (United States, Finland, France, Italy, Japan, United Kingdom, Sweden and Switzerland) filled out a questionnaire entitled "Ageing Population and Impact on the Labour Force". The comparison is based on the information that they provided.*

This report contains a summary of the data collected in the survey and a comparative analysis of national projections. It is divided into two chapters. The first chapter discusses future demographic changes in the countries studied. The second presents a comparison of the projections from various countries regarding the economically active population, participation in the labour force (particularly among those age 55 and over) and other economic variables.

1. Demographic projections

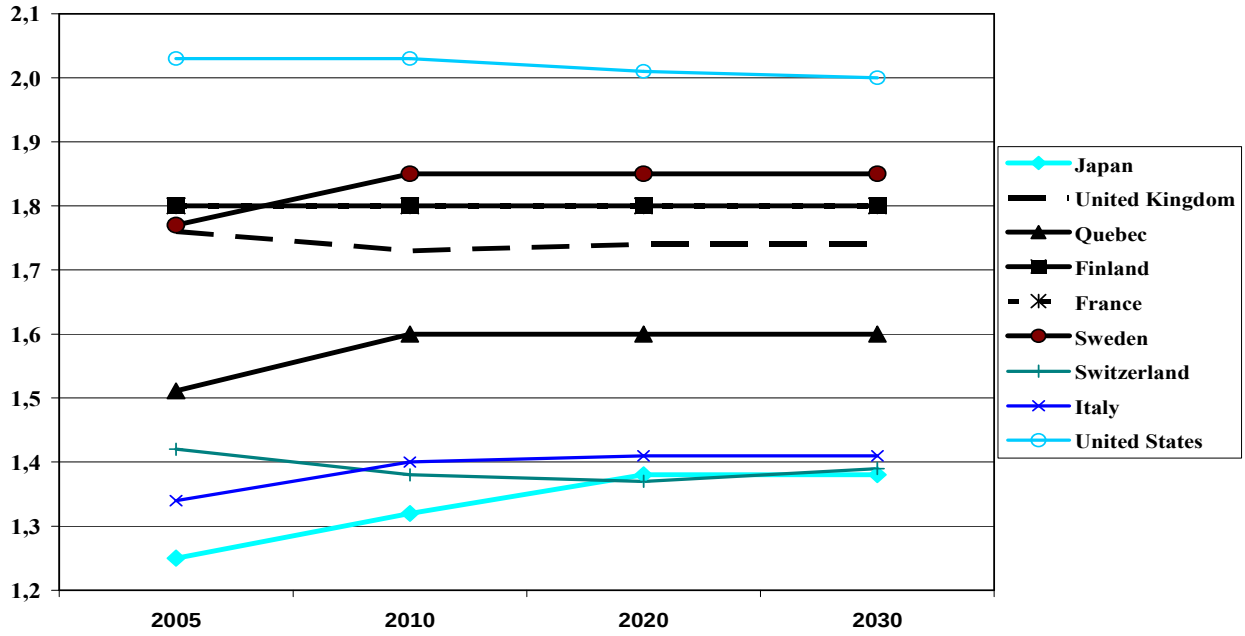
The first chapter provides details about the projected demographic environment of each country studied. A comparison is first established on the basis of three factors that determine population changes: total fertility rate, net migration and life expectancy. We then explain the effect of the demographic projections on future population distribution according to age, particularly the working-age population.

[1] The Quebec Pensions Board extends it thanks to the representatives of the social security schemes of the countries that responded to its survey for their valuable cooperation, namely Alice Wade, Deputy Chief Actuary, Social Security Administration, United States; Theri Luoma, Actuary, KELA (Social Insurance Institution), Finland; Michèle Tourne, Actuarial and Statistics Service Director, National Old-age Insurance Fund for Employees, France; Graziella Rambaldi, Actuary, National Social Insurance Institute, Italy; Yoshihiro Yumiba, Director, Office of Administration on Actuarial Coordination, Pension Bureau, Ministry of Health, Labour and Welfare, Japan; James Thompson, Actuary, Social Security, Government Actuary's Department, United Kingdom; Nils Holmgren and Lena Lundkvist, Researchers, *Försäkringskassan* (Swedish Social Insurance Agency), Sweden, and Laurence Capraro, Scientific Contributor, Federal Social Insurance Office, Switzerland.

1.1. Total fertility rate

Fertility, like immigration, is a factor that contributes to the growth of a country's population. It has a bearing on the influx of new workers within an approximately 20-year span. The number of new contributors is an important parameter to the funding of most social security schemes.

Figure 1. *Total fertility rate projections, 2005-2030*



Note: Data for Finland and France are the same.

In the countries studied in which birth rates are the currently the lowest (between 1.25 and 1.42 children per woman), that is, Japan, Switzerland, and Italy, rates are expected to remain low in the future, for example, around 1.4 in 2030. A second group made up of France, Finland, the United Kingdom and Sweden expects to maintain fertility rates around 1.8 children per woman. Québec is between these two groups, with an increase in the fertility rate to 1.6 by 2020.

These findings are illustrated in Figure 1. The United States can be seen at the upper limit of the graph with a fertility rate of 2.0.

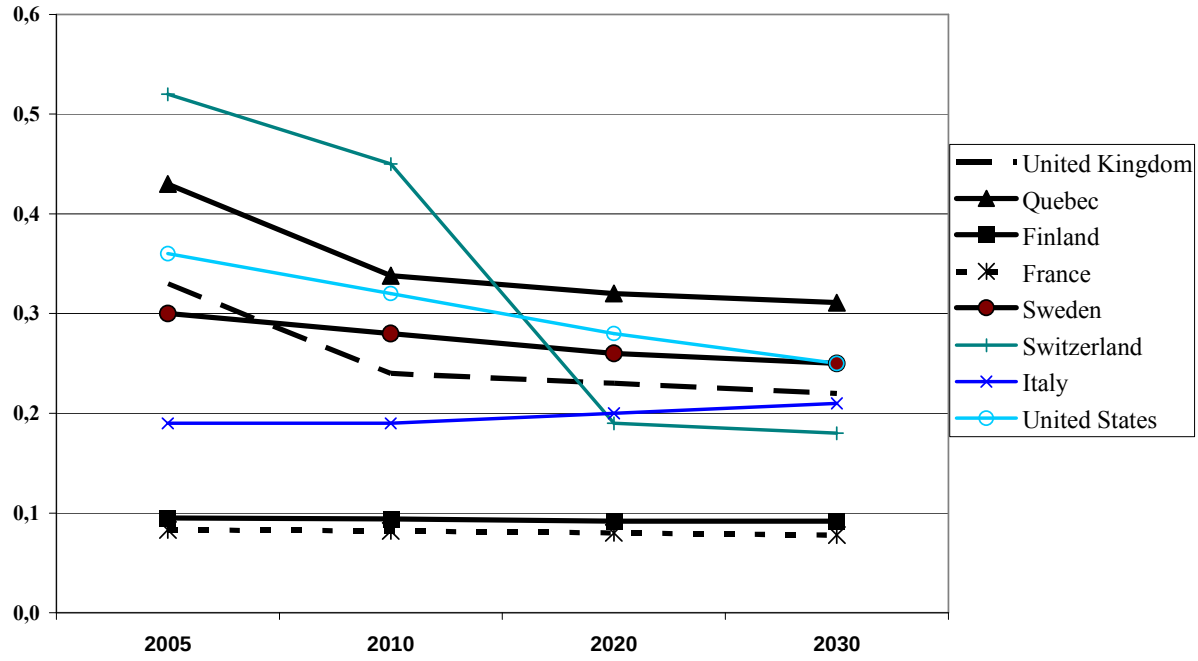
In all of the countries studied, the projected total fertility rate is lower than the level required to renew the population, that is, 2.1 children per woman. In 2030, the total fertility rate will vary between 1.4 et 2.0. In the absence of positive net migration, the population of several countries will decline over the next century. In the shorter term, the working-age population will decline once the number of retirees surpasses the influx of new workers.

1.2. Net migration

A positive net migration generally means an almost immediate influx of new workers, considering the age at which immigrants arrive in a new country. The actual effect on a plan's funding obviously varies according to the level of migration but also on the distribution of migrants according to age. The level of immigration and its composition depend on public policies related to immigration.

Net migration expressed as a percentage of the population varies significantly from country to country.[2] The net migration of most countries is relatively small and the projected levels of migration are not sufficient to offset the anticipated low fertility rates.

Figure 2. ***Projected net migration as a percentage of the population, 2005-2030 (in %)***



For example, net migration in France currently represents 0,08% of the population, compared with 0,52 % in Switzerland. Most countries, with the exception of Switzerland, anticipate very small changes in net migration as a percentage of the population. In Switzerland, however, migration is expected to decline to 0,18% of the population in 2030. In contrast, Italy anticipates a slight increase in the level of immigration.

1.3. Life expectancy

Life expectancy is an important demographic factor, in terms of a publicly-funded pension plan. The longer the life expectancy, the higher the costs associated with cash outflows, since the plan will be paying pension benefits over a longer period of time. Future changes in life

[2] Projected net migration in Japan is not available.

expectancy, however, are subject to several factors. It is therefore difficult to make long-term projections.

Table 1. ***Projection of life expectancy at birth, 2000-2030***

	2000	2010	2020	2030
Men				
Japan	77,7	78,6	79,4	80,1
United Kingdom	75,5	78,2	80,1	81,3
Québec	76,3	79,4	80,6	81,5
Finland	74,1	76,9	78,8	80,2
France	75,4	77,9	80,1	82,1
Sweden	77,3	79,2	80,8	82,0
Switzerland	77,2	79,8	81,9	83,3
Italy	76,4	77,9	79,6	81,4
United States	74,0	75,5	76,6	77,6
Women				
Japan	84,6	85,9	87,1	87,9
United Kingdom	80,2	82,1	83,8	84,9
Québec	81,9	83,8	84,7	85,3
Finland	81,0	83,1	84,2	85,4
France	82,9	84,9	86,6	88,2
Sweden	82,0	83,3	84,3	85,1
Switzerland	82,8	85,0	86,7	87,8
Italy	82,7	84,4	86,2	88,1
United States	79,4	79,9	80,7	81,6

As Table 1 shows, life expectancy at birth increases in all of the countries up to 2030. France is the country that projects the largest increases in life expectancy. French experts estimate that between 2000 and 2030, life expectancy will increase by 6,7 years for men and by 5,3 years for women. In 2030, France will therefore rank first in terms of life expectancy for women, surpassing even Japan.

The life expectancy gap between countries in 2030 is smaller in the case of men than for women. Life expectancy among men in 2030 is 77,6 years in the United States and 83,3 years in Switzerland, a 5,7 year difference. Among women, this difference is 6,6 years in 2030, with 81,6 years in the United States and 88,2 years in France.

Perceptions regarding changes in the life expectancy of women compared with that of men are different in each country. Most countries anticipate the gap in life expectancies between men and women to narrow by 2030. Japan, however, expects the gap to grow 1,0 year and Italy, 0,4 year.

Table 2. *Projection of life expectancy at age 65, 2000-2030*

	2000	2010	2020	2030
Men				
Japan	17,5	18,1	18,7	19,1
United Kingdom	15,7	18,0	19,6	20,5
Québec	16,3	18,4	19,1	19,7
Finland	15,5	17,2	18,5	19,4
France	16,7	18,0	19,3	20,5
Sweden	16,6	17,9	18,9	19,7
Switzerland	17,1	18,6	19,8	20,9
Italy	16,6	17,6	18,7	20,0
United States	15,9	16,6	17,3	17,9
Women				
Japan	22,4	23,4	24,4	25,1
United Kingdom	18,9	20,4	21,9	22,9
Québec	20,4	21,7	22,4	22,9
Finland	19,4	21,0	22,1	22,9
France	21,3	22,7	23,9	25,1
Sweden	20,0	20,9	21,6	22,2
Switzerland	20,9	22,2	23,3	24,1
Italy	20,7	22,0	23,5	25,1
United States	19,0	19,1	19,7	20,2

Life expectancy at age 65 provides a better indication of the period during which pensions will be paid under a pension plan. It increases rapidly in all of the countries studied. For men, life expectancy increases on average 3,3 years between 2000 and 2030. For women, the average increase is 3,1 years, and life expectancy at age 65 in 2030 is over 25 years in three of the countries studied. The United States ranks last for both sexes.

1.4. Population distribution according to age

The demographic assumptions examined above are used to compare the extent of the ageing phenomenon from one country to another. The proportion of people aged 65 and over within the total population will increase everywhere, although at different rates, depending on the country. Figure 3 shows the proportion of people aged 65 and over within the total population, for the period 2005-2030.

Figure 3. ***Changes in the proportion of people aged 65 and over within the total population (in percentage)***

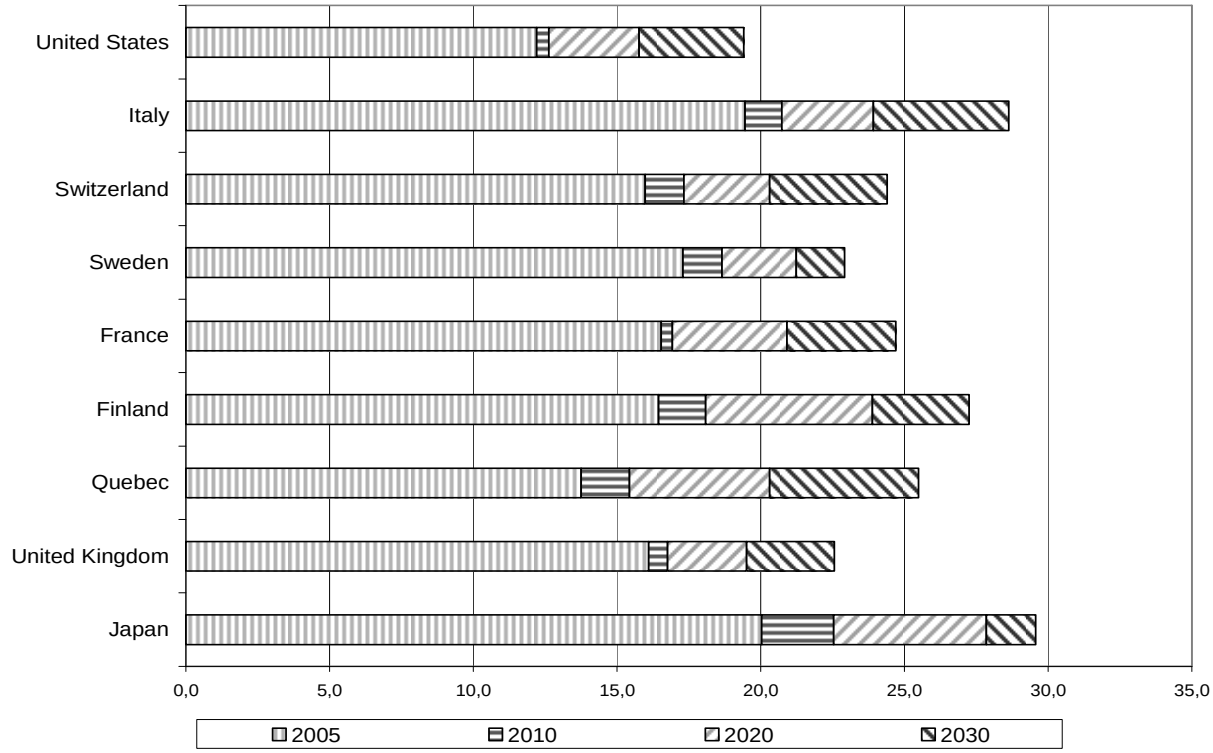


Figure 3 shows that the phenomenon of population ageing is generalized and that it will increase by 2030. Japan will experience the greatest and most rapid ageing of its population. The population aged 65 and over in Japan will increase from 20,0% in 2005 to 29,6% in 2030. By 2030, at least 25% of the population of Japan, Québec, Finland and Italy will be age 65 or over.

The United States will also experience an increase in the proportion of people aged 65 and over, but the proportion will not reach 20% by 2030. A higher fertility rate and higher net migration, combined with a lower life expectancy, allows the United States to maintain, over time, the smallest proportion of senior citizens.

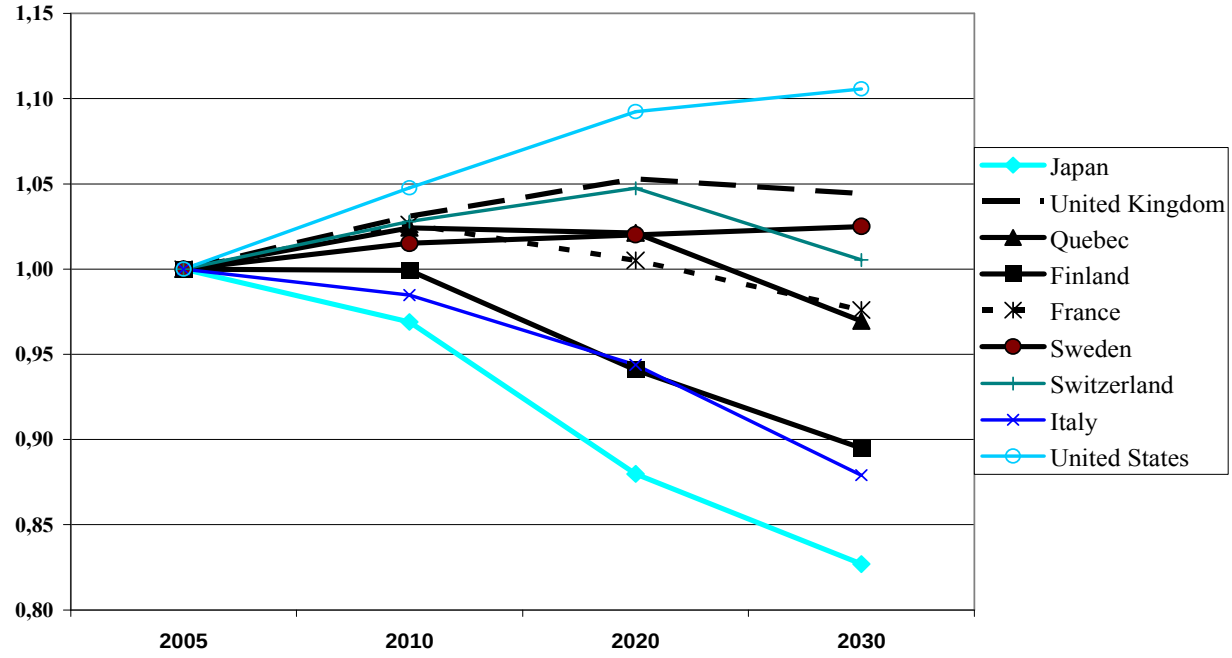
1.5. Working-age population

The size of the working-age population is a critical factor in a publicly-funded pension plan. Based on survey results, the working-age population in Japan, Italy and Finland will decline significantly by 2030 (see Figure 4). This situation is attributed to a more rapid and more substantial ageing of the population than that projected in other countries.

The Figure shows an overall change in the rate of change in the working-age population between 2005 and 2030; this change varies from one country to another according to its demographic structure. For five countries, projections for the working-age population indicate a reduction in this group between 2010 and 2020. Of those five, results for Italy and

Finland are similar. The United States and Sweden are the only two countries projecting continued growth among this segment of the population.

Figure 4. ***Changes in the working-age population (ages 20-64) compared to 2005 (2005 = 1.00)***



2. Projection of economic variables

Chapter two discusses future changes in labour market indicators, namely the active population, activity rates based on age and sex, employment and unemployment rates. The inflation rate and rate of increase in employment earnings are also part of the comparison.

There is little doubt that an ageing population will have a serious impact on the growth of the active population in the years to come. Indeed, the growth of Québec's active population, which varied around 1% a year between 1970 and the late 1990s, continues to slow down. If participation rates in the labour market remain unchanged, the active population, in Québec and in several countries, will stagnate (and even decline somewhat) over the next 25 years.

What effects will this stagnation of labour have on participation in the labour market? Two important questions arise:

- Over the coming years, what will be the activity rate among men aged 55 to 64?[3] Recently, a reversal of the trend in some countries among men in this age group to

[3] In most of the countries studied, 65 is the normal age of retirement. Thus, there is no analysis of the activity rate for persons aged 65 and over.

retire sooner from the labour force has been observed. How significant will this increase in the average age at retirement be?

- Will the gap between the activity rates of men and women continue to narrow? If so, to what degree?

2.1. Activity rates[4]

2.1.1. Activity of men aged 55 to 64

In recent years, most industrialized countries have registered a decline in the labour force participation rate among men aged 55 to 64. Combined with increased longevity, this trend towards progressively earlier retirement will have a profound impact on pension plan funding, particularly due to the longer periods during which pension benefits will be paid. In the short term, the arrival of baby-boomer generations in age groups with lower activity rates will shrink the labour supply.

However, in some countries (and in Québec), the opposite effect has been observed since 2000, and the activity rates of older workers are once again tending to increase.

The significant gap between men aged 60 to 64 and those aged 55 to 59 with regard to participation in the labour market warrants a separate analysis for the two groups.

Men aged 55 to 59

The most significant rise in activity rates between 1999 and 2005, an increase of 8 percentage points, took place in Finland. In comparison, the next largest increase, 5,3 percentage points, occurred in Québec. In contrast, during the same period a slight decrease in activity rates was observed in Japan, the country with the highest activity rates for this age group (94% in 2005).[5] For men aged 55 to 59, France and Finland had the lowest activity rates (70%) in 2005.

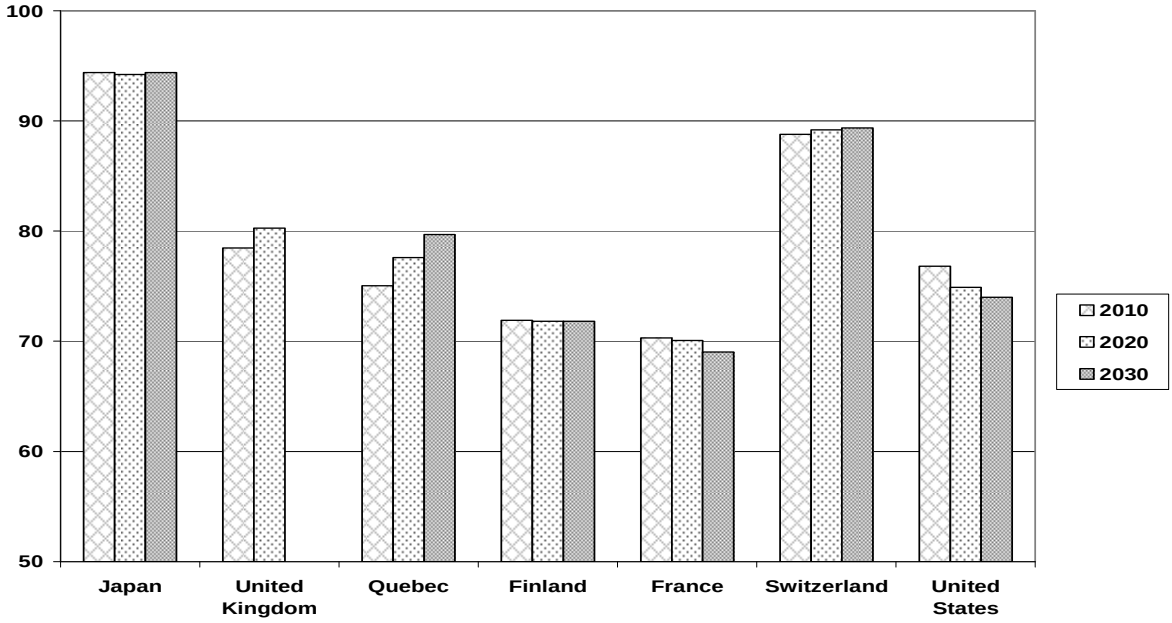
The projected reversal of the trend towards earlier retirement will be more pronounced in Québec, with the result that, over the next few decades, Québec will see the greatest growth in activity rates for men aged 55 to 59.

In contrast, almost all of the countries studied anticipate that the level of participation among men aged 55 to 59 will remain stable (or decline slightly) over the next few decades. In the United States, the activity rate among men aged 55 to 59 is expected to decrease on the order of 3% between 2010 and 2030. Figure 5 shows projections of labour force participation rates for the 55 to 59 age group.

[4] Anticipated activity rates for Sweden and Italy, as well as those for the United Kingdom in 2030, are not available.

[5] The record rate of participation in the labour market among older Japanese men is attributed primarily to the implementation of gradual retirement measures in particular, reassigning older workers to lower-paying jobs with fewer work hours, which is supported by a government policy (see bibliography: Beausoleil and Crespo, 1999).

Figure 5. ***Activity rates for men aged 55 to 59 (in percentage)***

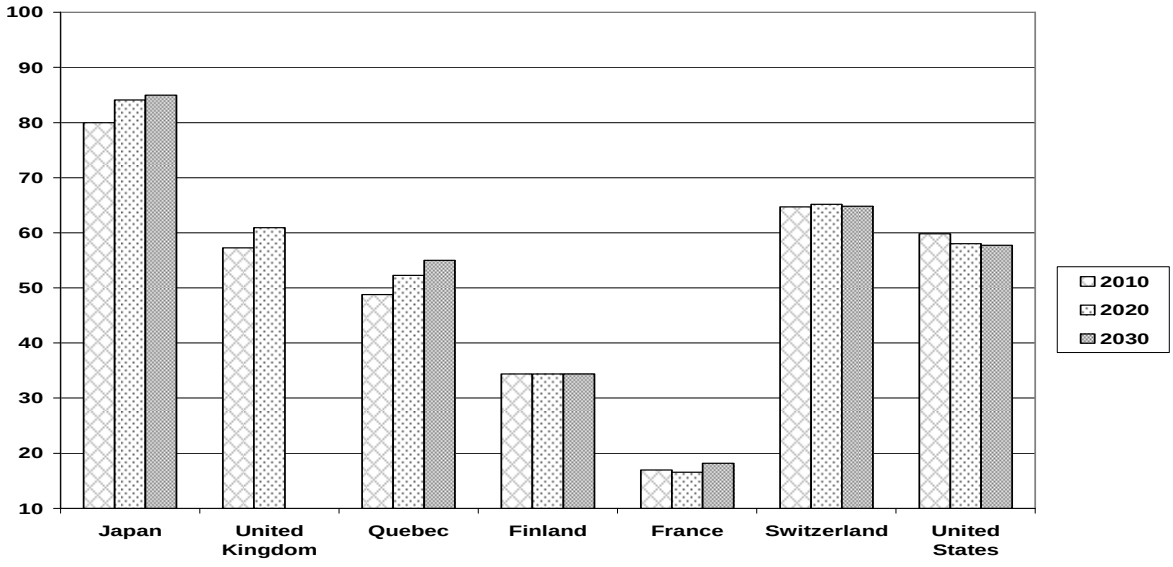


Men aged 60 to 64

In all of the countries studied (as well as in Québec), activity rates for men in this age group declined between 1980 and 1999. However, the opposite situation can be observed for the period since 1999, except in Japan. In spite of the continued decrease in Japanese activity rates, which remain high in comparison with the other countries studied, a significant increase is expected in the coming decades. An increase in the activity rates among men aged 60 to 64 is also expected in the United Kingdom and in Québec. For the other countries, activity rates for men aged 60 to 64 are expected to remain relatively stable up to 2030.

Figure 6 shows activity rate projections for men aged 60 to 64.

Figure 6. ***Activity rates for men aged 60 to 64 (in percentage)***



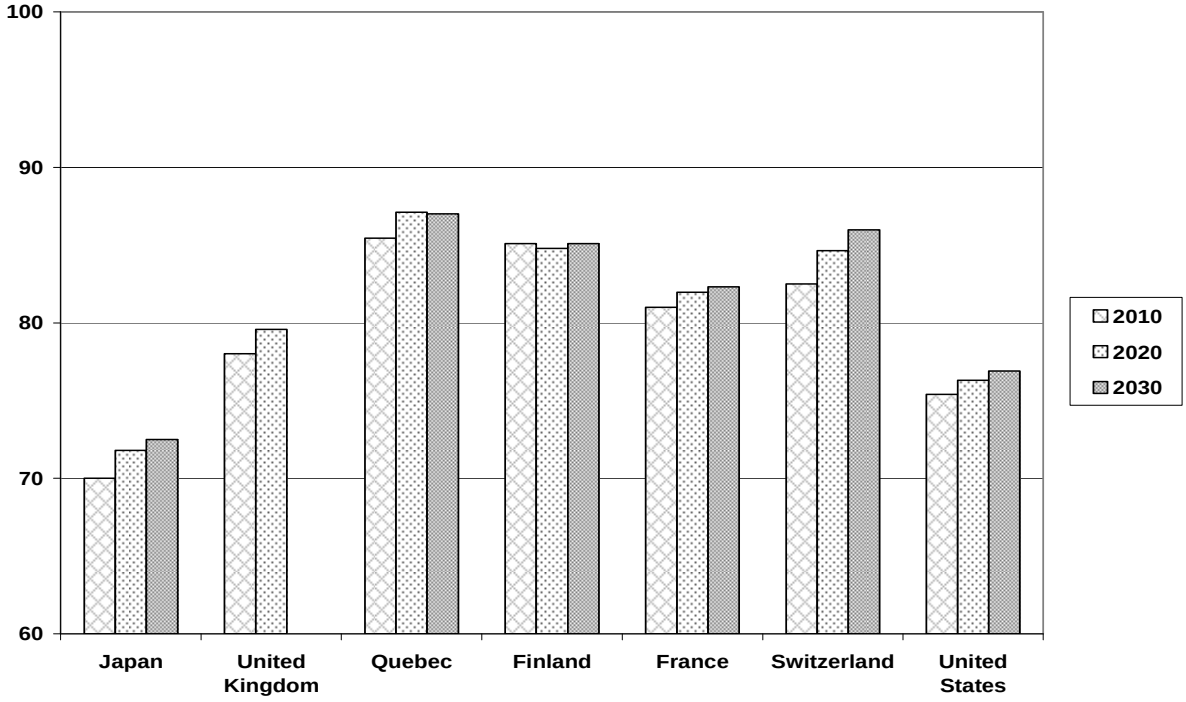
2.1.2. Activity of women

The participation of women in the work force has grown steadily since the mid-1950s, which has contributed in part to growth of the active population. This trend is expected to continue over the next few years, but generally at a slower pace.

The 25-to-54 age group was examined to determine the participation of women in the labour market.[6] For men and women, this age group accounts for the largest number of workers. It will therefore be used to analyze projections of the activity rates for women and changes in the differences between these rates and the activity rates of men.

Activity rates among women are highest in Québec, Finland and Switzerland. The United States and Japan show the lowest activity rates for women. Analysis of the progression of the activity rate for women aged 25 to 54 reveals that an increase is projected everywhere, except in Finland, where it is expected to level off (Figure 7).

Figure 7. ***Activity rates for women aged 25 to 54 (in percentage)***

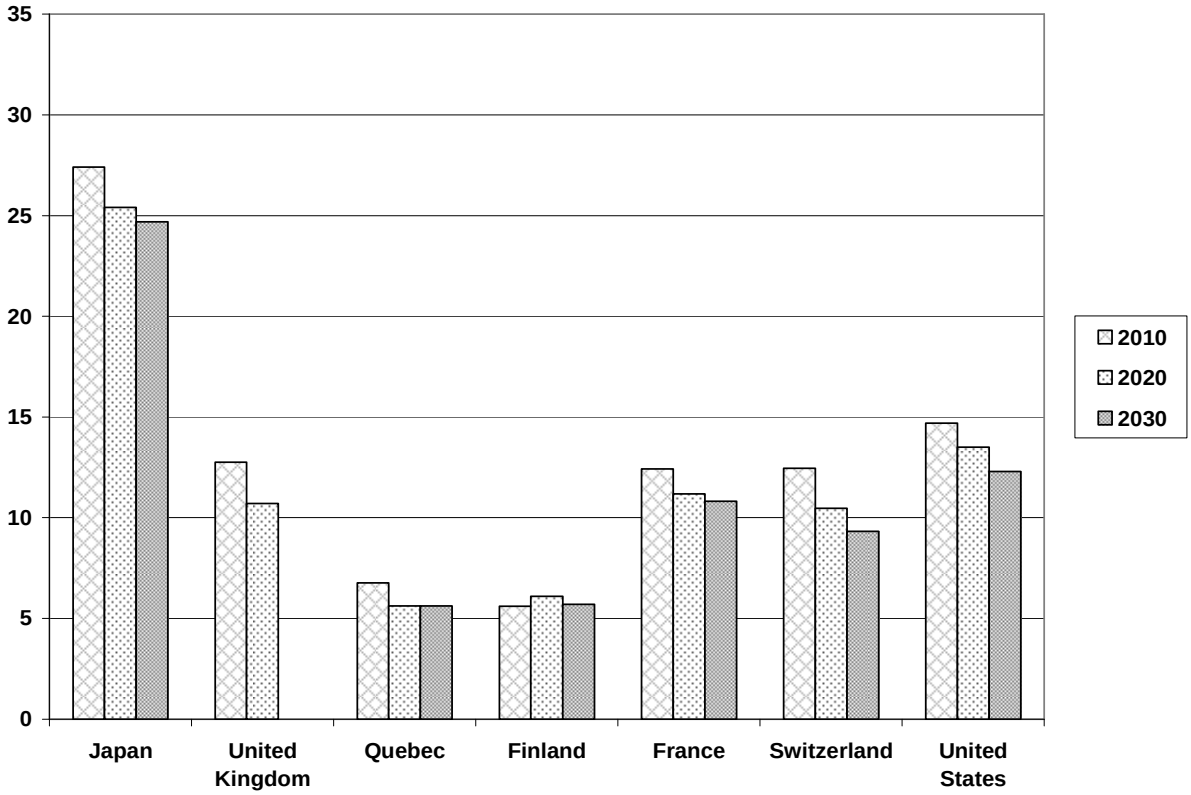


The gap in activity rates between the sexes, in all of the countries studied except Finland, is expected to narrow over the next 30 years. In Finland (where the gap is narrowest in 2030), the difference is expected to be on the order of 5% (Figure 8).

[6] Persons aged 25 and under are often still attending school, and the labour market participation rates of men and women aged 55 and over vary significantly.

Japan's situation is very different from that of the other countries studied, with a gap of over 25% (except in 2030) between the activity rates of men and women. According to a German author,[7] the Japanese man continues to have the role of sole provider of the family income, and still receives important social employment protection. In the United States and Europe, the man's previous role as sole provider has markedly declined.

Figure 8. ***Difference in the activity rates of men and women (aged 25-54) (in percentage)***



2.2. Employment growth

Due to changes in the working-age population and rates of participation in the labour force, employment over the next 30 years is expected to stagnate. Between 2006 and 2010, the average annual growth of employment should be strongest in the United States, at 1,1%. The smallest projected growth is in Japan, where employment will decrease on average 0,4% a year over the same period. After 2010, employment growth drops off in all of the countries studied, with the exception of the United Kingdom.

Table 3 shows projections for average annual employment growth for the period 2006-2030. Generally speaking, these projections are particularly weak compared with historical data. For comparison purposes, Table 4 shows average annual employment growth in recent years for the various countries studied as well as for Québec.

[7] See Auer (1996).

Table 3. *Projection of average annual employment growth*[1)]

	2006-2010 %	2011-2020 %	2021-2030 %	2006-2030[2)] %
Japan	-0.40	-0.50	-0.60	-0.53
United Kingdom	-0.10	0.00	-0.20	-0.10
Québec	0.60	0.00	0.00	0.10
France	0.70	0.20	-0.30	0.07
Finland	0.19	0.13	-0.01	0.08
Sweden	0.50	0.00	0.00	0.18
Italy	0.60	n/a	n/a	n/a
United States	1.07	0.46	0.30	0.49

[1)] Data for Switzerland is not available.
[2)] Calculation by the authors.

Table 4. *Rate of employment growth among persons aged 15 and over (for certain periods)*

	Period	Percentage
Japan	1973-2005	0.6
United Kingdom[1)]	1987-2005	0.7
Québec	1976-2005	1.3
France	1991-2004	0.8
Finland	1994-2005	1.4
Sweden	1993-2004	0.6
Switzerland	1991-2005	0.4
Italy	1993-2003	0.7
United States[2)]	1994-2005	1.3

[1)] Persons aged 15 to 74.
[2)] Persons aged 16 and over.

Future economic growth for most industrialized countries is expected to be fuelled less by employment and more by labour productivity, which has an effect on the real rate of increase in earnings. Data and projections on real rates of increases in earnings are given in section 2.6.

2.3. Unemployment

Due to slower growth of the active population, most countries expect the unemployment rate to fall. Finland, France, Sweden and Québec project the unemployment rate to drop sharply by 2020. The most significant change is expected in France, where the rate will decrease from 9,8% in 2005 to 4,5% in 2020.[8] This rapid decrease is probably due to the 2003 pension reform, which was supposed to "delay by 5 years the beginning of the decrease in the active population, and which, without the reform, would have occurred in 2010".[9]

[8] In fact, the long-term unemployment rate of 4,5% is reached in 2015 according to the projections.
[9] See the retirement advisory council report (*Conseil d'orientation des retraites* 2006) in the bibliography.

In the United Kingdom, the unemployment rate is expected to remain around 5,0% over the same period. In the United States, it will increase slightly and remain stable at 5,4% after 2020. Table 5 shows unemployment rates in 2005 and those projected in 2010, 2020 and 2030 for the countries studied, as well as Québec.

Table 5. ***Unemployment rates in 2005 and projected rates for 2010, 2020 and 2030***[1)]

	2005 %	2010 %	2020 %	2030 %
United Kingdom	5.1	5.1	4.9	4.9
Québec	8.3	7.5	6.0	6.0
France	9.8	7.0	4.5	4.5
Finland	8.4	7.0	6.0	6.0
Sweden	5.9	4.6	4.7	4.7
Italy	7.7	7.5	n/a	n/a
United States	5.1	5.1	5.5	5.5

[1)] Switzerland and Japan do not make projections on their unemployment rates. Japan instead calculates a ratio of the number of employees participating in the social security system out of the active population, by age and sex.

2.4. Number of contributors to the public pension plan

It is of interest to examine changes in the number of contributors to the various pension plans in the context of an ageing society. In countries anticipating little variation in activity rates, changes related to the number of contributors are generally similar to those in the population aged 20 to 64.

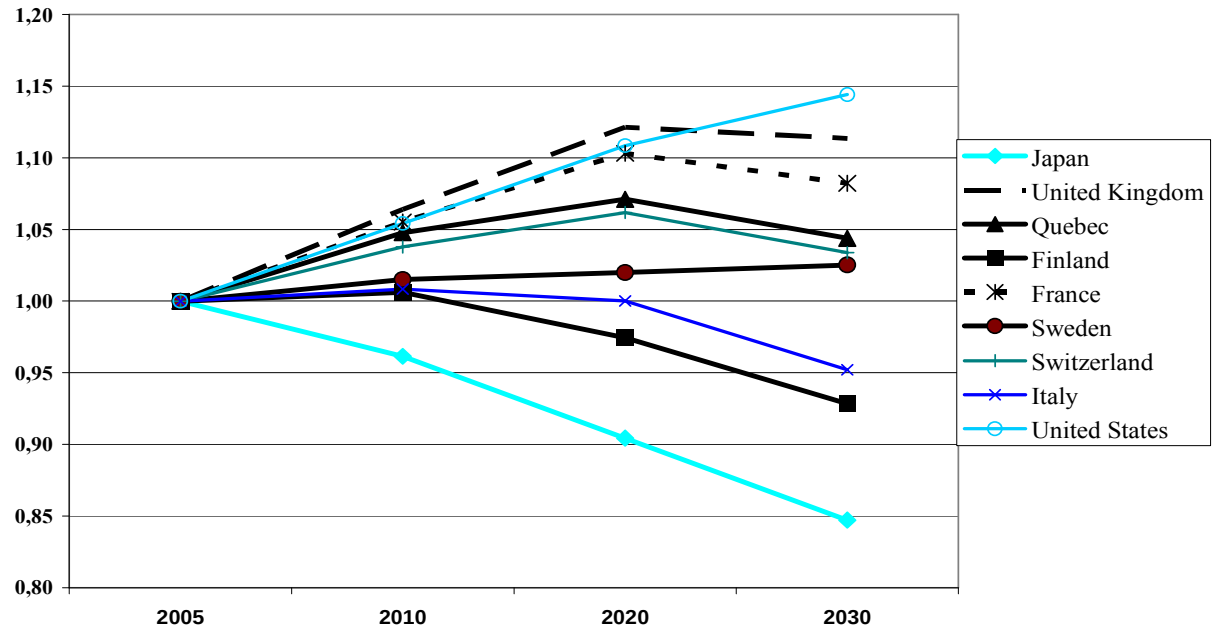
In the United States and Sweden, the number of contributors will continue to grow until 2030. In other countries, growth will not be continuous over the entire period. In Italy and Finland, the number of contributors will grow during the period 2005-2010, and then drop over the 20 years that follow. In the United Kingdom, France, Québec and Switzerland, the effect of the baby-boom on the total number of contributors is expected to be felt later; growth is expected to continue until 2020, and fall after that time. In Japan, the decline will be constant over the next three decades.

A smaller number of contributors generally causes the pay-as-you-go contribution rate to increase.[10] Only Italy, Finland and Japan are projected to have fewer contributors in 2030 than in 2005. In Québec, a large part of the gain in new contributors results from a freeze on the minimum pensionable earnings on which workers contribute the public pension plan.[11]

[10] This rate is calculated by dividing cash outflows for one year by the total contributory payroll for the same year.

[11] This level of earnings is commonly called the "basic exemption".

Figure 9. *Changes in the number of contributors compared to 2005 (2005 = 1.00)*



2.5. Inflation

Between 2000 and 2005, average inflation went over 2,5% only in the United States. In general, inflation now seems to be under control, even in Japan, which grappled with deflation from 1999 to 2005. This control can be attributed to the fact that over the last few years, most central banks have implemented a monetary policy based on a fixed inflation target. For example, the primary goal of the European Central Bank (the central bank of the euro area, which includes Finland, France and Italy, among the countries studied) is to keep inflation in the euro area below 2%. The Bank of England, the Bank of Canada[12] (in the case of Québec) and the Bank of Sweden have the same target. The Swiss National Bank equates price stability with "a rise in the national consumer price index (CPI) of less than 2% per annum."[13] In the United States, however, the inflation-control target is somewhat implied. In fact, the objective of the United States Federal Reserve can be defined as keeping inflation low enough to ensure that prices remain stable.[14]

In March 2006, the Bank of Japan ended after 5 years a "quantitative easing" strategy. Price stability is the objective of the new framework for analyzing monetary policy. In concrete

[12] On 23 November 2006, the Bank of Canada, together with the Canada Department of Finance, renewed the inflation target of 2% for another five-year period, ending 31 December 2011. Their joint statement appeared on the Bank of Canada Website (http://www.bankofcanada.ca/en/press/2006/pr06-18.html).

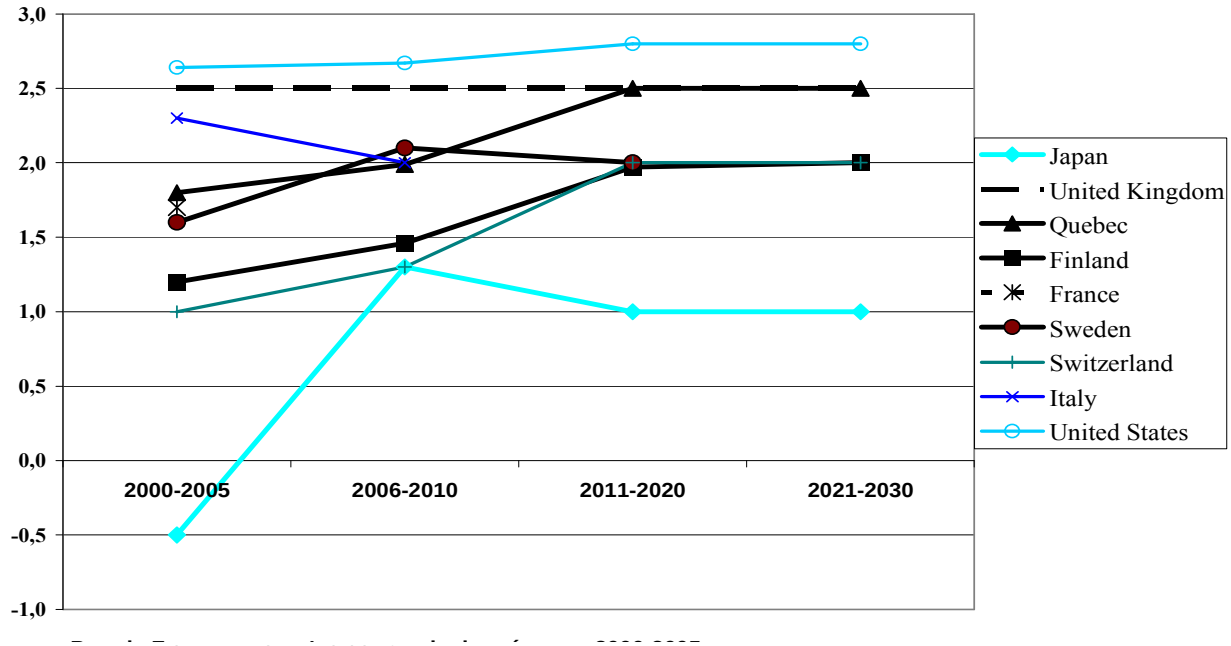
[13] The Swiss National Bank's monetary policy strategy appears on its Website (http://www.snb.ch/e/geldpolitik/geldpol.html).

[14] According to Goodfriend (2003), it would be difficult to image a situation where the Federal Reserve would target a reference CPI below 1% or above 2%, for the short or long term. Poole (2005) points out that the question of whether the inflation target should be explicitly expressed, as the average of an interval or a precise point, is the object of debate.

terms, the Bank is trying to keep increases in the global consumer price index between 0% and 2%.[15]

The projected long-term inflation rates stabilize quickly over time, within a range of 1,5% to 3,0%. The United Kingdom anticipates inflation to be stable as of the 2005-2010 period, whereas the other countries studied (as well as Québec) expect this type of stability to begin in the following decade. Figure 10 shows average inflation rates between 2000 and 2005 and projected average rates up to 2030.

Figure 10. ***Average inflation rates for the period 2000-2005 and projected inflation rates for 2006-2030***



Note: For France, data is only available for 2000-2005.

2.6. Real rate of increase in employment earnings

For the 2000-2005 period, the average real rate of increase in employment earnings was between -0,4% and 2,6%. For the 2006-2010 period, the average real rate of increase in earnings is expected to be between 0,2% in Italy and 2,1% in Sweden. Over the longer term, the rate varies between 1,0% (Switzerland) and 2,0% (Sweden, between 2011 and 2020).

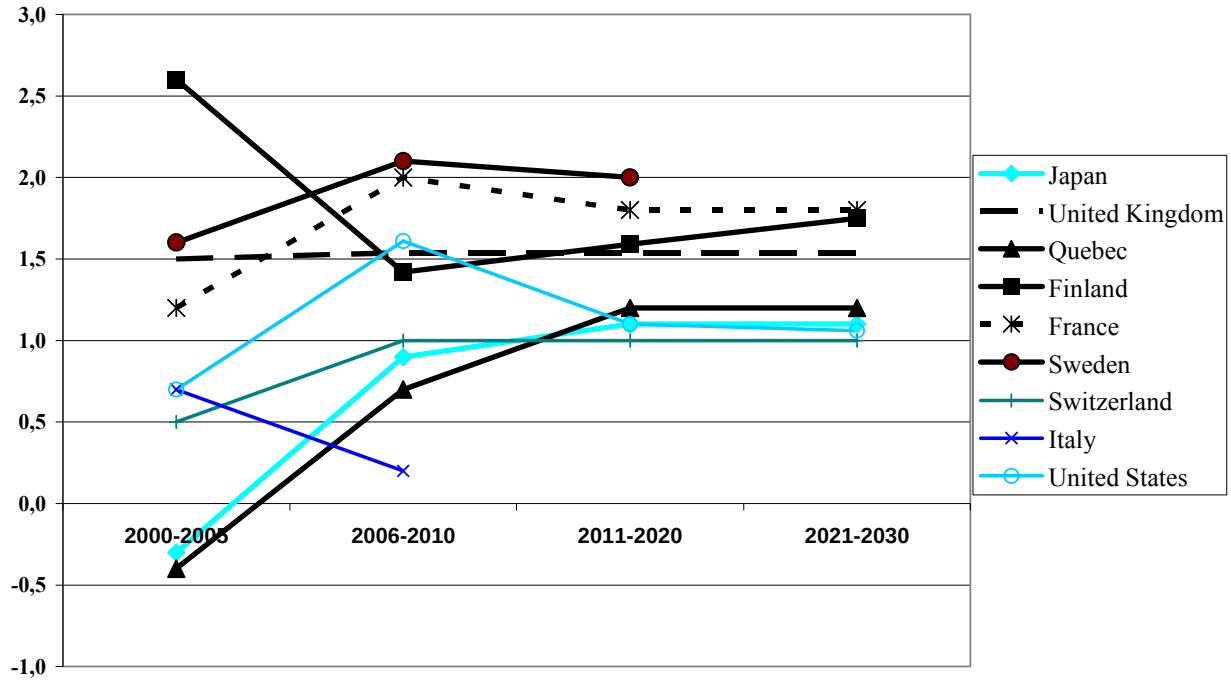
Generally speaking, up to 2030, the projected rates of increase are higher than those recorded during the 2000-2005 period. With a decline of the long-term growth in employment (see section 2.2), one can assume that growth of the real GDP will be mainly attributable to increased labour productivity, which will affect the real rate of increase in earnings. In the case of the United States and France, compared with the period from 2006 to 2010, growth of employment and the real rate of increase in earnings should decline in the following decades.

[15] Ministry of Finance of Quebec (2006).

One can conclude that the economic scenario of these countries projects growth of the real GDP to slow down significantly by 2030. In Québec, growth of the real GDP is also expected to be lower after 2010 than during the 2006-2010 period. However, the real rate of increase in earnings is expected to be higher after 2010.

Figure 11 shows the average real rates of increase in employment earnings for the period of 2000-2005 and projected rates up to 2030.

Figure 11. ***Average real rate of increase in employment earnings***



Conclusion

The comparisons presented in this report were used as the basis for assessing the future demographic environment of the countries analyzed. This environment will be such that in the decades to come, the population of most of the countries studied will age appreciably. This population shift, particularly in the working-age population, may significantly impact participation in the labour force. By 2030, the active population in most of the countries will stagnate or decline slightly.

As for gaps between men and women with regard to participation in the labour market, most countries expect the participation of women to increase and, over the next few decades, the gap to narrow even more. In most of the countries studied, the unemployment rate is expected to drop significantly and job growth is expected to be weak or negative.

Almost all of the actuaries consulted in the various social security agencies therefore expect a very different labour force from that observed in the 1990s. Economic growth in the coming

decades should result primarily from work productivity, rather than employment growth, as was the case at the end of the 20th century. This increase in productivity should pave the way for a stronger real rate of increase in earnings than in the past. Finally, inflation is expected to remain low over the long term, although at a higher level than that observed since 2000.

Bibliography

Auer, P. 1996. "Taux d'activité et taux d'emploi en Europe: convergence ou divergence?", in *Observateur européen de l'emploi*, Winter.

Beausoleil, J.; Crespo. S. 1999. *La sortie anticipée d'activité des travailleurs de 45 à 64 ans: fiches techniques*, Montréal, Université du Québec, Institut national de la recherche scientifique.

Conseil d'orientation des retraites. 2006. "Les hypothèses économiques", in *Retraites: perspectives 2020 et 2050* (rapport No. 3). http://www.cor-retraites.fr/article289.html.

Goodfriend, M. 2003. *Inflation targeting in the United States?.* Federal Reserve Bank of Richmond.

Ministère des Finances du Québec. 2006. *Suivi de la conjoncture économique: Japon – conduite de la politique monétaire*, Direction de l'analyse et de la prévision économique.

Poole, W. 2006. "The Fed's Monetary Policy Rule", in *Review*, The Federal Reserve Bank of St-Louis.