

Population and Labour Force Projections for Singapore (1999-2049)

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Abstract

Singapore is experiencing a slowdown in its resident-population growth rate. Fertility rate has fallen below the replacement level and is constantly declining. In this study, an attempt has been made to project the population and labour force of Singapore for next five decades. Eleven different scenarios are projected. These scenarios are based on a variety of assumptions about fertility, mortality, migration and labour force participation rates.

We find that migration will continue to play an important role in Singapore's population growth. If Singapore is to meet its growing need for labour force, it will have to rely more on foreign labour in the years to come. The second most important factor determining the rate of population growth in Singapore would be the fertility rate. An increase in the total fertility rate (TFR) from the current level of 1.5 to 2.1 in next two decades will have a positive effect on its population growth. However, looking at the past and present trends of TFR, this prospect seems highly unlikely.

Our labour force projection results imply an even greater reliance on foreign workers. Owing to good health conditions in Singapore the life expectancy is high and on the rise. This will result in aging population and reduction in the local supply of labour. This trend cannot be reversed in the short-run even if the TFR is increased to the replacement level. We also observe an increase in the dependency ratio.

Key Words: Population Projections, Labour Force Projections, Migration, Declining Fertility, Singapore Population, Singapore Labour Force.

JEL Classification: J1

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1. Introduction

Singapore has been one of the fastest growing economies of the world in last three decades with an average annual growth rate of around 7 percent per annum. Singapore's resident population growth rate (including permanent immigrants) has been around 1.7 percent over the same period. To fulfil the growing demand for labour, Singapore has increasingly relied on foreign labour. In this study we attempt to project Singapore's resident population and labour force in next five decades under eleven different scenarios. This study is a part of our main study of Singapore's labour market where we model the demand for labour and use the labour force projections here to derive the demand for foreign workers in Singapore in years to come.

The basic objective of studying so many possible scenarios is to see the impact of varying assumptions on population and labour force and try to single out the most important policy variables.

There have been few studies on Singapore's population and labour force projections [see, for example, Saw (1987) and Shantakumar (1996)]. These and other similar studies have now become outdated as the latest of them uses 1990 as the base year. Another problem with these studies is that they ignore migration and base their projections on a very limited set of assumptions. Our study is an improvement over the previous studies in two respects. First, we update the projections and use 1999 as the base year. Second, we not only allow for migration but also make varying assumptions about it and combine it with a variety of assumptions about fertility. This makes our projections more comprehensive and reliable in the face of the uncertain future.

2. Projection Methodology and Results

Our projections can be divided into three parts, namely: Population, Labour Force Participation Rate and Labour Force Projections. In the following we outline the methodology for each of these and also present the results.

2.1 Population Projections

Population projections are based on the well known component method [see UN (1956)]. This method is commonly used to project population by age and sex. The above cited studies and CoA (1991) use the same method for their projections. For ease in computations we use PEOPLE (Version 3.01). It is a software that can produce population projections using component method and some input statistics under a certain set of assumptions. There are four broad categories of inputs and/or assumptions which we need to specify before producing the desired projections:

a. Base Population:

Our first input variable is Base Population involving base-year (1999 in our case) population by age and sex. We use data from Year Book of Statistics (2000), Singapore. The actual input data is given in Table 1. We call this base population POP11 in forthcoming discussion.

b. Fertility Rates:

Six different sets of fertility assumptions have been made. In all cases we use Age Specific Fertility Rates (ASFR's) and Total Fertility Rate (TFR) for the year 1999 as the starting point. These ASFR's and TFR are given in Table 2.

Then the following six assumptions are considered (FERT 11 to 16 are the names given to these assumptions for future use).

1. FERT11: TFR remains constant at 1.475 throughout the projection period (i.e. 1999-2049).
2. FERT12: TFR increases from 1.475 in 1999 to 1.7 in 2049. The change has been assumed to be slow in the beginning and fast later.
3. FERT13: TFR decreases from 1.475 in 1999 to 1.25 in 2049. The change has been assumed to be fast in the beginning and slow later.
4. FERT14: TFR increases linearly from 1.475 in 1999 to 1.7 in 2019 and then remains at 1.7 until 2049.
5. FERT15: TFR increases linearly from 1.475 in 1999 to 2.1 in 2019 and then remains at 2.1 until 2049.
6. FERT16: TFR falls linearly from 1.475 in 1999 to 1.2 in 2019 and then remains at 1.2 until 2049.

In cases where we assume an increase (decrease) in TFR, we increase (decrease) the ASFRs proportionately holding constant their relative values for different age groups.

c. Mortality Assumption:

Life expectancy figures (by sex) for the base and end periods of projections are also required. For Singapore the latest available life expectancy figures belong to the year 1997 [see The World Bank (2000)]. We take the same figures for 1999. For the end period of projections (i.e. 2049) we assume that Singapore's life expectancy will grow in 2049 to Japan's 1997-level,

latter being the highest in the world in 1997. These mortality assumptions are given in Table 3.

We assumed linear increase in mortality rates. This assumption is named MORT11 for future use.

d. Migration Assumption:

In order to make reasonable assumptions about migration, we studied the change in the resident population to establish the migration pattern in last 10 years [i.e. from 1990 to 1999, inclusive]. The average number of permanent immigrants to Singapore was found to be 20,725 (per year) for 1990-94 and 26,567 (per year) for 1995-99. Based on these estimates we make the following two migration assumptions:

1. Every year 30,000 permanent immigrants enter Singapore and this number remains the same for the entire projection period [i.e. 1999-2049].
2. Every year 30,000 permanent immigrants enter Singapore and this number will grow by 5,000 every 10 years. This pattern of immigrants has been shown in Table 4.

The input files containing these assumptions have been labelled MIG12 and MIG11, respectively.

With regard to migration, another issue to decide is the age and sex composition of immigrants. The 1989-99 pattern was analysed to estimate the percentage of immigrants by age and sex for 1989-94 and 1994-99 separately and then the two were averaged. The resulting percentages are in Table 5.

Using different combinations of the above assumptions, eleven different population projections were generated. These projections were labelled PROJ11, PROJ12... PROJ21. Table 6 shows different combinations of inputs used to generate each projection.

After specifying the inputs in the PEOPLE, we are able to extract a detailed report on eleven scenarios of projected population. The output from PEOPLE contains details about the projected population like age composition, survivorship rates, dependency ratios etc. However, for the sake of brevity we have presented the projected population (Table 7) and growth rate (Table 8) figures for all eleven scenarios at five-year intervals. Population figures have been presented in millions and the growth rates are in percentages.

2.2 *Labour Force Participation Rate (LFPR) Projections*

In order to project LFPR's we obtain LFPR data (by age and sex from 1973 to 1999) from Singapore Department of Statistics' on-line database called Time series Retrieval and Dissemination (TREND). Using these 27 observations (excluding extreme outliers) we fit a linear time trend to each age group separately. There are 13 age groups for males and females each. In all we have 26 time trend equations. We extrapolate these trends until 2049, imposing certain ceilings and floors. These ceilings and floors are the highest or the lowest LFPR's (by age and sex) achieved by Germany, Japan, Sweden and Hong Kong. First three countries are selected because they have almost the highest LFPR's in the world. The choice of Hong Kong is based on the fact that its economy resembled that of Singapore in many ways. Table 9 shows ceilings (c) and floors (f) for different age groups. The cases where no ceiling or floor has been imposed are the ones where our extrapolated trend does not hit any ceiling or floor until 2049. Using the above methodology we project the LFPR's as given in Table 10.

2.3 *Labour Force Projections*

As a final step we simply multiply the projected population with the projected LFPR's. This gives us the projected labour force. As we have eleven different scenarios for population projections, corresponding to each of them we have eleven different labour force scenarios. These eleven labour force projections have been reported in Table 11 and their corresponding growth rates in Table 12.

3. **Analysis of Population Projections**

Out of the eleven scenarios, we have selected the following six for our analysis.

1. PROJ11: Total Fertility Rate (TFR) remains the same at its 1999 level and number of immigrants increases from 30,000 p.a. in 1999 to 50,000 p.a. in 2049.
2. PROJ14: TFR remains the same at its 1999 level and number of immigrants remains at 30,000 p.a. throughout.
3. PROJ18: TFR increases from 1.475 in 1999 to 2.1 in 2019 and remains constant thereafter. Number of immigrants remains at 30,000 p.a. throughout.
4. PROJ19: TFR decreases from 1.475 in 1999 to 1.2 in 2019 and remains constant thereafter. Number of immigrants remains at 30,000 p.a. throughout.
5. PROJ20: TFR increases from 1.475 in 1999 to 2.1 in 2019 and remains constant thereafter. There is no migration.

6. PROJ21: TFR remains the same at its 1999 level and there is no migration.

3.1 *Constant TFR and Changing Migration (PROJ 21, 14 and 11)*

We start with PROJ21, PROJ14 and PROJ11. In all three cases TFR has been assumed to remain constant at its 1999 level (i.e. 1.475). PROJ21 is without migration, PROJ14 is with constant annual migration of 30,000 and PROJ11 is with annual migration gradually increasing from 30,000 to 50,000.

In case of PROJ21, population rises from 3.22m (in 1999) to a maximum of 3.44m (in 2024) and then declines to 2.95m (in 2049). If we look at the growth rates the pattern is clear. Starting from a growth rate of 0.58% p.a., we see gradual reduction in growth rate that turns negative after 2024. As we have kept the TFR constant at 1.475, which is below the replacement level, and allowed no migration, a decline in total population is expected. However, for first 25 years of our projections the absolute population is increasing. This is simply because during this period the number of births, although declining, is higher than the number of deaths. However, after 2024, the number of deaths over takes the number of births and we see an absolute decline in the population.

PROJ14 is a little more optimistic as compared to PROJ21. Under PROJ14, although the TFR remains at 1.475, we assume a constant annual inflow of 30,000 migrants. Under these assumptions population rises from 3.22m (in 1999) to 5.23m (in 2049). However, the growth rate of population declines steadily from 1.53% (during 1999-2004) to 0.49% (during 2044-49). We see the dominant impact of a low fertility rate in depressing population growth rate. Despite a regular annual inflow of 30,000 immigrants, the growth rate keeps on declining. The reason for this is simple: constant addition of 30,000 bears a smaller proportion to a growing total population. If this trend continues, the growth rate will eventually turn negative.

PROJ11 is even more optimistic as it allows a constantly increasing number of immigrants. In this case we see that population grows from 3.22m (in 1999) to 5.91m (in 2049). On the growth front, the growth rate has declined from 1.53% (during 1999-2004) to 0.97% (during 2044-49). However, this decline has not been steady. In fact, when we increase the number of immigrants by 5,000 after 10 years, the growth rate in the next interval slightly increases.

Comparing the above three cases we conclude that migration will play a very important role in determining the future course of Singapore's population. This is so because the TFR is expected to stay below the replacement level. The only alternative to migration is an increase in the TFR. But looking at the past trend of TFR in Singapore this seems unlikely.

3.2 *Constant Migration and Changing TFR (PROJ 14, 18 and 19)*

To gain further insights into the expected population dynamics we consider another comparison. This time we hold migration constant at a level of 30,000 immigrants per year and change TFR. In PROJ14 the TFR is constant at 1.475. In PROJ18 we allow TFR to increase from 1.475 (in 1999) to 2.1 (in 2019) and thereafter it is assumed to remain constant. In PROJ19 we allow the TFR to drop from 1.475 (in 1999) to 1.2 (in 2019) and thereafter it remains constant.

PROJ14 has already been analyzed above. PROJ18 is an interesting case and our assumption of increasing the TFR to 2.1 in just 20 years is motivated by the assumption that Singaporeans respond positively to the incentives given by the government to increase the family size. The implications are interesting. The population will grow from 3.22m (in 1999) to 6.25m (in 2049). This is the biggest increase among all six scenarios we have selected for our analysis. The growth rates are also quite reasonable. For the first 20 years (when TFR is rising), the growth rate fluctuates between 1.53 and 1.59%. After 2019 it declines and for the last ten years it once again stabilizes around 1.05%. This case is very encouraging. A TFR of 2.1 can roughly be considered the replacement level of TFR. When we add migration to it we see an increasing population.

PROJ19 is the other side of the coin. When we decrease the TFR to 1.2 in just 20 years and keep it constant thereafter we have a result that is remarkably different from PROJ18. Population in this case will grow from 3.22m (in 1999) to just 4.79m (in 2049). The growth rate will steadily decline from 1.47% (during 1999-2004) to 0.23% (during 2044-49). This case calls for special attention by the policy makers. Looking at the past trend of TFR in Singapore, a further decline to 1.2 is not a remote possibility especially when we know that there are many countries in the world that have already achieved a TFR of 1.2 or below [World Bank(1999)]. At the same time, a constant migration of 30,000 is also quite a reasonable assumption. Although this case is based on reasonable assumptions, the outcome is not favourable at all and we shall see below that this type of population pattern will have serious implications for the supply of local labour force.

3.3 *No Migration and Changing TFR (PROJ20 and 21)*

Finally we compare two cases without migration. In PROJ20 we allow TFR to increase from 1.475 (in 1999) to 2.1 (in 2019) and keep it constant thereafter. PROJ21 assumes a constant TFR of 1.475 throughout. In PROJ20, the population will grow from 3.22m (in 1999) to 3.56m (in 2049). Population growth rate will decline from 0.60% (during 1999-2004) to -0.20% (during 2044-49). The population will increase until 2029 and decline thereafter.

When we compare PROJ20 with PROJ21 (analyzed above) we see that an increasing TFR can have very healthy effect on population even in absence of migration. However, from the point of view of labour force (as we shall see later), this result is not very encouraging.

We conclude from our analysis of various possible scenarios of Singapore's population that migration will play an important role in Singapore's population growth in next fifty years. The second most important factor will be the TFR. If Singapore can increase its TFR to 2.1 in next two decades, it will have a very desirable effect on the population growth. However, if the past declining trend of TFR continues, as is expected, Singapore will have to rely more on migration to sustain a desired growth in population and hence in labour force.

4. Analysis of Labour Force Projections

We analyse the same six scenarios for labour force as we have done for population.

4.1 Constant TFR and Changing Migration (PROJ21, 14 and 11)

First we compare PROJ21, PROJ14 and PROJ11. All three projections assume constant TFR. PROJ21 is under the assumption of no migration, PROJ14 assumes constant annual migration of 30,000 and PROJ11 assumes annual migration of 30,000, which increases by 5000 every 10 years.

Under PROJ21, labour force (LF) will decline from 1.64m (in 1999) to 1.37m (in 2049). Growth rate of labour force will decline consistently from 0.96% (during 1999-2004) to -1.02% (during 2044-49). As this projection is without the migration so the results are not surprising.

Under PROJ14, the labour force will grow from 1.64m (in 1999) to 2.66m (in 2049). The growth rate of labour force will decline from 2.05% (during 1999-2004) to 0.42% (during 2024-29). It will rise to 0.66% (during 2034-39) and fall again to 0.35% (during 2044-49). There are two interesting features of the growth pattern in labour force when we compare it with the growth pattern of population under the same assumptions. First, the growth of labour force is faster than the growth in population for first half of our projections. This is mainly because most of the migrants are in active age groups. During the second half of our projections, however, the early migrants move into older age groups and we observe a slower growth rate of labour force as compared to population. Second, although the population growth rate declines constantly over the entire projection period the growth rate of labour force declines in the beginning and then rises for some time before declining again. We will have more on these dynamics when we consider the dependency ratios below.

Under PROJ11, the labour force will grow from 1.64m (in 1999) to 3.08m (in 2049). The growth rate pattern is similar to that of PROJ14 although numbers differ. Labour force growth rate will decline from 2.05% (during 1999-2004) to 0.74% (during 2024-29). It will rise to 1.11% (during 2034-39) and then fall again to 0.91% during (2044-49).

4.2 *Constant Migration and Changing TFR (PROJ14, 18 and 19)*

Recall that PROJ14, PROJ18 and PROJ19 all assume a constant annual migration of 30,000 over the entire projection period. They differ, however, in their assumptions concerning the TRF. PROJ14 is done under the assumption of constant TFR; PROJ18 assumes an increasing TFR (from 1.475 in 1999 to 2.1 in 2019 and constant thereafter) and PROJ19 assumes a decreasing TFR (from 1.475 in 1999 to 1.2 in 2019 and constant thereafter). We have already analyzed PROJ14 above. Now we turn to PROJ18 and PROJ19.

Under PROJ18 the labour force will grow from 1.64m (in 1999) to 3.03m (in 2049). The growth rate pattern is similar to that of PROJ14. Growth rate will decline from 2.05% (during 1999-2004) to 0.65% (during 2024-29). It will rise to 1.25% (during 2034-39) and then fall again to 1.00% (during 2044-49).

Under PROJ19, the labour force will grow from 1.64m (in 1999) to 2.48m (in 2049). The growth rate of labour force will fall from 2.05% (during 1999-2004) to 0.30% (during 2024-29). It will rise to 0.40% (during 2034-39) and then fall again to -0.03% (during 2044-49).

4.3 *No Migration and Changing TFR (PROJ20 and 21)*

These two cases are without migration. In PROJ20, we assume an increasing TFR (from 1.475 in 1999 to 2.1 in 2019 and constant thereafter) while PROJ21 is under the assumption of constant TFR. PROJ21 has already been analyzed so we discuss PROJ20 below and then compare it with PROJ21.

Under PROJ20, the labour force will grow from 1.64m (in 1999) to 1.82m (in 2014). Thereafter, it will first decline to 1.62m (in 2029) and then stabilize around this figure for the next 20 years. The growth rate of labour force will decline from 0.96% (during 1999-2004) to -0.89% (during 2024-29). It will then increase to 0.08% (during 2039-44) and then fall again to -0.12% (during 2044-49).

The most striking feature of these two projections is that whether TFR is held constant or increased to 2.1 in just 20 years, if there is no migration, the labour force will fall in both cases. These projections further highlight the importance of immigrants in Singapore's labour force.

5 Dependency Ratios

In order to capture the dynamics of our population and labour force projections together we define the Dependency Ratio (DR) as the ratio of Population to Labour Force:

$$\text{Dependency Ratio} = \text{Population} / \text{Labour Force}$$

It is a useful ratio that tells us how population and labour force move together. An increasing DR implies that population is growing faster than the labour force while a decreasing DR implies the opposite. We have shown DR's for six selected projections in Table 13. The dynamics are quite interesting.

First, we compare PROJ21, PROJ14 and PROJ11. Although the DR's move together for these three projections we see that when there is no migration the DR is the highest (PROJ21). When we incorporate the migration, DR falls and for PROJ11, where the migration is the highest, we see the lowest DR's.

The comparison between PROJ14, PROJ18 and PROJ19 is more interesting. If we take the case of constant TFR (i.e. PROJ 14) as a benchmark and compare the other two cases with it we see that the ultimate DR is higher when TFR is increased and lower when TFR is reduced. The obvious reason is that with higher TFR we have more births that tend to increase the DR. A similar phenomenon is observed when we compare PROJ20 and PROJ21. PROJ20 has a higher TFR and thus results in higher DR.

6. Age Specific Growth Rates of Labour Force

In considering the age-specific growth rates of labour force (see Table 14), over the entire period of the projections, the highest growth rates are observed in the age group 50-64 for both males and females. This is true for projections with or without migration. However, the rates are much higher when projections are done with migration. Another notable feature of Table 14 is that regardless of the population assumptions, an overall negative growth rate for all the age groups above 65 is observed. This is due to the projected declining LFPR's for these groups.

7. Summary and Conclusions

This study aims to analyse Singapore's population and indigenous labour force growth over next five decades under eleven different scenarios. Population projections are based on certain assumptions about fertility, mortality and migration. Labour force participation rates (LFPR's) are projected by extrapolating the past 27-year trend into future imposing certain ceilings and floors. Finally the labour force is projected by combining the population and LFPR projections.

The study shows that Singapore will have to rely more on migration to sustain a reasonable growth rate of population. A sharp increase in TFR can also bring about the desired effects but this prospect is highly unlikely. In fact, looking at the trend in Singapore's TFR over last three decades and also keeping in view the experience of other developed countries in the past, it is reasonable to assume that Singapore will experience a further decline in TFR in the years to come. Given this assumption, there is no other way open to Singapore except to rely more on immigration.

The labour force projections add to the pessimism created by population projections. Most of the immigrants to Singapore are in their prime. After two to three decades, most of them will be in their old age thus increasing the percentage of aging population on one hand and reducing the labour force on the other. Owing to this fact, we see that growth rate of labour force in second half of our projected period is very low.

The overall conclusion that emerges from this study is an expected increase in immigration in Singapore. This may have some serious repercussions for the society and portend a possible slowing down of growth rate. Another obvious problem that Singapore is bound to face is that of rapidly aging population.

As the purpose of this study, as spelled out in the beginning, has only been to project population and labour force, the question of further implications of these projections will be the subject of future research.

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Table 1: Base Population (Resident Population of Singapore in 1999 by age and sex in 000's)

Age Groups (Years)	Male	Female	Total
0-4	121.0	112.8	233.8
5-9	131.4	123.1	254.5
10-14	118.3	110.7	229.0
15-19	108.0	101.1	209.1
20-24	107.2	108.1	215.3
25-29	131.9	139.1	271.0
30-34	144.4	147.4	291.8
35-39	160.0	156.5	316.5
40-44	153.2	147.6	300.8
45-49	127.0	121.6	248.6
50-54	90.7	88.9	179.6
55-59	63.9	64.8	128.7
60-64	50.7	53.0	103.7
65-69	39.7	43.3	83.0
70-74	28.9	33.7	62.6
75-79	18.2	22.5	40.7
80+	19.1	29.7	48.8
Total	1613.6	1603.9	3217.5

Source: Singapore Department of Statistics (2000), *Year Book of Statistics*, Singapore, p. 25.

Table 2: Age Specific and Total Fertility Rates (1999) Per 1000 Female Population

Age Groups (Years)	ASFRs
15-19	8.3
20-24	36.5
25-29	105.0
30-34	99.3
35-39	39.4
40-44	6.6
TFR	1475

Source: Singapore Department of Statistics (2000), *Year Book of Statistics*, Singapore, p. 26.

**Table 3: Mortality Assumptions
(Life Expectancy at Birth)**

Sex\Year	1999	2049
Male	73	77
Female	79	83

Figures for 1999 are actual Life Expectancy figures for Singapore as in 1997. Figures for 2049 are Life Expectancy figures for Japan in as in 1997. We assume that Life expectancy in Singapore will increase to Japan's current level in 2049.

Table 4: Assumed Annual Inflow of Immigrants

Period	Annual Inflow of Immigrant
1999-2009	30,000
2009-2019	35,000
2019-2029	40,000
2029-2039	45,000
2039-2049	50,000

Table 5: Estimated Percentage of Immigrants (By Age and Sex)

Age Groups	Males	Females	Total
0-4	3.76	3.69	7.45
5-9	2.35	2.28	4.63
10-14	1.21	1.85	3.06
15-19	4.14	9.89	14.03
20-24	10.66	16.78	27.44
25-29	8.93	10.30	19.23
30-34	6.12	5.39	11.51
35-39	4.11	2.82	6.93
40-44	2.49	1.34	3.83
45-49	1.12	0.49	1.61
50-54	0.19	0.11	0.30
Total	45.08	54.94	100.02

1. Estimated by the author (total does not add up to 100 because of rounding).
2. Data used for these calculations covered the period from 1989 to 1999.

Table 6: Eleven Scenarios (Input and Output Files)

Population Input File	Fertility Input File	Mortality Input File	Migration Input File	Projected Population Output File
POP11	FERT11	MORT11	MIG11	PROJ11
POP11	FERT12	MORT11	MIG11	PROJ12
POP11	FERT13	MORT11	MIG11	PROJ13
POP11	FERT11	MORT11	MIG12	PROJ14
POP11	FERT12	MORT11	MIG12	PROJ15
POP11	FERT13	MORT11	MIG12	PROJ16
POP11	FERT14	MORT11	MIG12	PROJ17
POP11	FERT15	MORT11	MIG12	PROJ18
POP11	FERT16	MORT11	MIG12	PROJ19
POP11	FERT15	MORT11	No Migration	PROJ20
POP11	FERT11	MORT11	No Migration	PROJ21

Table 7: Population Projections Under Different Assumption (in millions)

Years	PROJ ^a										
	11	12	13	14	15	16	17	18	19	20	21
1999	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22
2004	3.47	3.47	3.46	3.47	3.47	3.46	3.47	3.48	3.46	3.32	3.31
2009	3.71	3.72	3.70	3.71	3.72	3.70	3.72	3.75	3.69	3.40	3.38
2014	3.98	3.99	3.95	3.96	3.96	3.92	3.99	4.05	3.91	3.48	3.41
2019	4.26	4.26	4.20	4.20	4.21	4.14	4.26	4.39	4.12	3.57	3.44
2024	4.55	4.57	4.47	4.44	4.45	4.35	4.53	4.72	4.30	3.64	3.44
2029	4.83	4.86	4.71	4.65	4.67	4.53	4.77	5.04	4.46	3.67	3.41
2034	5.11	5.15	4.95	4.82	4.87	4.68	4.99	5.33	4.58	3.67	3.34
2039	5.36	5.43	5.16	4.97	5.03	4.78	5.18	5.62	4.67	3.64	3.23
2044	5.63	5.74	5.38	5.10	5.19	4.87	5.36	5.92	4.73	3.60	3.09
2049	5.91	6.06	5.60	5.23	5.36	4.94	5.55	6.25	4.79	3.56	2.95

^a These projections have been numbered from 11 to 21 and are based on different assumptions about TFR and migration (mortality assumption remains unchanged). In the following we briefly describe these assumptions.

Proj11: TFR remains constant at 1.475 and migration gradually increases to 50,000 as shown in Table 4.

Proj12: TFR increases from 1.475 to 1.7 and migration gradually increases to 50,000 as in Table 4.

Proj13: TFR decreases from 1.475 to 1.25 and migration gradually increases to 50,000 as in Table 4.

Proj14: TFR remains constant at 1.475 and migration remains at 30,000 throughout

Proj15: TFR increases from 1.475 to 1.7 and migration remains at 30,000 throughout

Proj16: TFR decreases from 1.475 to 1.25 and migration remains at 30,000 throughout

Proj17: TFR increases from 1.475 in 1999 to 1.7 in 2019 and then remains constant until 2049, migration remains at 30,000 throughout

Proj18: TFR increases from 1.475 in 1999 to 2.1 in 2019 and then remains constant until 2049, migration remains at 30,000 throughout

Proj19: TFR decreases from 1.475 in 1999 to 1.2 in 2019 and then remains constant until 2049, migration remains at 30,000 throughout

Proj20: TFR increases from 1.475 in 1999 to 2.1 in 2019 and then remains constant until 2049, there is no migration

Proj21: TFR remains constant at 1.475 throughout and there is no Migration

Table 8: Projected Population Growth Rates Under Different Assumptions

PROJ^a

Years

11

12

13

14

15

16

17

18

19

20

21

1999-2004

1.53

1.53

1.49

1.53

1.53

1.49

1.52

1.56

1.47

0.60

0.58

2004-2009

1.37

1.37

1.30

1.37

1.37

1.30

1.42

1.53

1.28

0.51

0.38

2009-2014

1.40
1.41
1.33
1.27
1.28
1.19
1.37
1.56
1.16
0.48
0.22

2014-2019

1.34
1.36
1.25
1.20
1.22
1.11
1.34
1.59
1.04
0.48
0.13

2019-2024

1.35
1.39
1.25
1.10
1.13
0.99
1.24
1.49
0.89
0.40
0.02

2024-2029

1.19
1.24
1.08
0.93
0.98

0.82
1.05
1.30
0.72
0.19
-0.17

2029-2034

1.12
1.18
0.99
0.75
0.81
0.62
0.88
1.14
0.53
-0.02
-0.42

2034-2039

0.97
1.06
0.83
0.60
0.68
0.45
0.76
1.06
0.38
-0.17
-0.67

2039-2044

0.99
1.10
0.84
0.52
0.63
0.35
0.71
1.05
0.28
-0.22

-0.85

2044-2049

0.97

1.11

0.80

0.49

0.64

0.31

0.69

1.06

0.23

-0.20

-0.93

^a These eleven projections are the same as in Table 7.

Table 9: LFPR Ceilings (c) and Floors (f)

Age Groups (Years)	Male	Female
15-19	15.8 (f)	13.6 (f)
20-24	66.7 (f)	84.7 (c)
25-29	None	95.1 (c)
30-34	98.5 (c)	97.0 (c)
35-39	98.7 (c)	97.3 (c)
40-44	None	96.5 (c)
45-49	None	95.8 (c)
50-54	None	90.6 (c)
55-59	None	None
60-64	None	None
65-69	None	None
70-74	0.6 (f)	0.3 (f)
75+	0.4 (f)	0.2 (f)

Source: ILO (1994-96)

Table 10: Projected LFPRs

Age	1999	2004	2009	2014	2019	2024	2029	2034	2039	2044	2049
Males											
15-19	17.0	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
20-24	74.2	69.8	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7

25-29	95.3	94.9	94.5	94.1	93.6	93.2	92.8	92.4	92.0	91.5	91.1
30-34	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5
35-39	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7	98.7
40-44	98.1	98.0	98.0	98.0	98.0	98.0	97.9	97.9	97.9	97.9	97.8
45-49	96.8	97.0	97.2	97.4	97.5	97.7	97.9	98.1	98.1	98.1	98.2
50-54	91.2	91.6	91.9	92.3	92.7	93.1	93.4	93.8	94.2	94.6	94.9
54-59	72.9	73.1	73.3	73.6	73.8	74.0	74.3	74.5	74.8	75.0	75.2
60-64	46.9	45.0	43.2	41.3	39.5	37.6	35.8	33.9	32.1	30.2	28.4
65-69	30.0	27.8	25.6	23.4	21.2	19.0	16.7	14.5	12.3	10.1	7.9
70-74	16.8	14.6	12.3	10.1	7.8	5.6	3.3	1.1	0.6	0.6	0.6
75+	7.2	5.5	3.7	2.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Females											
15-19	16.9	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
20-24	81.0	82.7	84.4	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7
25-29	87.4	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1
30-34	73.7	82.0	90.2	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0
35-39	65.4	72.6	79.9	87.1	94.4	97.3	97.3	97.3	97.3	97.3	97.3
40-44	63.0	70.7	78.3	86.0	93.6	96.5	96.5	96.5	96.5	96.5	96.5
45-49	58.0	65.8	73.6	81.4	89.3	95.8	95.8	95.8	95.8	95.8	95.8
50-54	44.4	50.3	56.2	62.1	68.0	73.9	79.7	85.6	90.6	90.6	90.6
54-59	27.9	31.0	34.0	37.0	40.1	43.1	46.2	49.2	52.3	55.3	58.3
60-64	13.9	14.4	14.8	15.3	15.7	16.2	16.7	17.1	17.6	18.0	18.5
65-69	7.3	6.7	6.1	5.4	4.8	4.2	3.6	2.9	2.3	1.7	1.1
70-74	4.3	3.8	3.4	2.9	2.4	1.9	1.4	1.0	0.5	0.3	0.3
75+	1.5	1.3	1.0	0.7	0.4	0.2	0.2	0.2	0.2	0.2	0.2

Table 11: Projected Labour Force (in millions)

Years	PROJ ^a										
	11	12	13	14	15	16	17	18	19	20	21
1999	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64
2004	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.72	1.72
2009	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.78	1.78
2014	2.18	2.18	2.18	2.16	2.16	2.16	2.16	2.16	2.16	1.82	1.82
2019	2.31	2.31	2.31	2.28	2.28	2.28	2.28	2.28	2.28	1.81	1.81
2024	2.42	2.42	2.41	2.35	2.35	2.34	2.35	2.36	2.34	1.74	1.74
2029	2.51	2.51	2.49	2.40	2.40	2.38	2.41	2.43	2.37	1.67	1.64
2034	2.64	2.64	2.60	2.46	2.46	2.43	2.49	2.55	2.42	1.62	1.56
2039	2.79	2.79	2.73	2.54	2.55	2.49	2.60	2.72	2.46	1.62	1.50
2044	2.94	2.95	2.86	2.61	2.63	2.54	2.70	2.88	2.49	1.63	1.44
2049	3.08	3.10	2.97	2.66	2.68	2.55	2.78	3.03	2.48	1.62	1.37

^a These eleven projections are the same as in Table 7.

Table 12: Projected Labour Force Growth Rates (%)

Years	PROJ										
	11	12	13	14	15	16	17	18	19	20	21
1999-2004	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	0.96	0.96
2004-2009	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	1.89	0.71	0.71
2009-2014	1.76	1.76	1.76	1.61	1.61	1.61	1.61	1.61	1.61	0.45	0.45
2014-2019	1.23	1.23	1.22	1.06	1.06	1.05	1.06	1.07	1.05	-0.14	-0.15
2019-2024	0.92	0.92	0.87	0.61	0.62	0.56	0.62	0.68	0.55	-0.73	-0.79
2024-2029	0.74	0.75	0.65	0.42	0.42	0.33	0.49	0.65	0.30	-0.89	-1.14
2029-2034	0.97	0.99	0.86	0.53	0.55	0.41	0.68	0.97	0.35	-0.55	-1.07
2034-2039	1.11	1.14	0.97	0.66	0.70	0.51	0.87	1.25	0.40	-0.05	-0.79
2039-2044	1.09	1.14	0.93	0.54	0.59	0.36	0.76	1.18	0.20	0.08	-0.77
2044-2049	0.91	0.98	0.73	0.35	0.43	0.14	0.57	1.00	-0.03	-0.12	-1.02

Table 13: Dependency Ratios

Years	PROJ					
	11	14	18	19	20	21
1999	1.96	1.96	1.96	1.96	1.96	1.96
2004	1.91	1.92	1.91	1.90	1.93	1.92
2009	1.86	1.86	1.88	1.85	1.91	1.90
2014	1.83	1.83	1.88	1.81	1.91	1.87
2019	1.84	1.84	1.93	1.81	1.97	1.90
2024	1.88	1.89	2.00	1.84	2.09	1.98
2029	1.92	1.94	2.07	1.88	2.20	2.08
2034	1.94	1.96	2.09	1.89	2.27	2.14
2039	1.92	1.96	2.07	1.90	2.25	2.15
2044	1.91	1.95	2.06	1.90	2.21	2.15
2049	1.92	1.97	2.06	1.93	2.20	2.15

Table 14: Average Annualised Age-Specific Growth Rates of Labour (1999-2049)

Age	PROJ					
	11	14	18	19	20	21
Males						
15-19	0.74	0.44	1.15	0.00	-0.17	-0.95
20-24	0.95	0.63	1.20	0.25	-0.11	-0.79
25-29	0.81	0.47	1.00	0.16	-0.30	-0.99
30-34	0.72	0.39	0.86	0.17	-0.46	-1.11
35-39	0.45	0.13	0.46	-0.01	-0.87	-1.35
40-44	0.44	0.15	0.33	0.06	-0.91	-1.15
45-49	0.80	0.55	0.58	0.49	-0.51	-0.55
50-54	1.56	1.37	1.37	1.37	0.53	0.53
55-59	2.22	2.08	2.08	2.08	1.32	1.32
60-64	1.30	1.20	1.20	1.20	0.41	0.41
65-69	-0.29	-0.34	-0.34	-0.34	-1.11	-1.11
70-74	-4.05	-4.08	-4.08	-4.08	-4.62	-4.62
75-79	-2.47	-2.48	-2.48	-2.48	-2.67	-2.67
Total	0.86	0.60	0.86	0.46	-0.28	-0.61
Females						
15-19	0.66	0.30	0.97	-0.11	-0.46	-1.24
20-24	1.46	1.04	1.55	0.71	0.04	-0.64
25-29	1.19	0.77	1.24	0.50	-0.27	-0.96
30-34	1.44	1.04	1.46	0.84	-0.07	-0.73
35-39	1.47	1.10	1.40	0.98	-0.15	-0.63
40-44	1.54	1.22	1.38	1.14	-0.09	-0.33
45-49	2.02	1.76	1.79	1.71	0.46	0.42
50-54	3.11	2.92	2.92	2.92	1.86	1.86
55-59	3.80	3.67	3.67	3.67	2.70	2.70
60-64	3.02	2.94	2.94	2.94	1.93	1.93
65-69	-1.44	-1.48	-1.48	-1.48	-2.34	-2.34
70-74	-2.90	-2.92	-2.92	-2.92	-3.40	-3.40
75-79	-0.60	-0.61	-0.61	-0.61	-0.72	-0.72
Total	1.73	1.41	1.67	1.28	0.29	-0.06
Grand Total	1.27	0.97	1.23	0.83	-0.03	-0.36