

Population Projections for Korea (2015~2065)

I . Results

1. Total population and population growth rate

- According to the medium growth scenario, the total population is projected to rise from 51,010 thousand persons in 2015 to 52,960 thousand persons in 2031. Afterwards, the total population is projected to record 43,020 thousand persons in 2065.
- According to the high growth scenario (assuming a high total fertility rate, a high life expectancy at birth and a high-level net international migration), the total population is projected to drop to 49,980 thousand persons in 2065 after recording a peak of 55,420 thousand persons in 2038.
- According to the low growth scenario (assuming a low total fertility rate, a low life expectancy at birth and a low-level net international migration), the total population is projected to drop to 36,660 thousand persons in 2065 after recording a peak of 51,680 thousand persons in 2023.
- The annual population growth rate is projected to decrease from 0.53 percent in 2015. Beginning a minus population growth rate in 2032, the annual population growth rate will reach -1.03 percent in 2065.

[Table 1] Total population (1965-2065)

Indicator	Scenario	1965	1975	1985	1995	2005	2015	2025	2035	2045	2055	2065
Total population (10 thousand persons)	Medium growth	2,870	3,528	4,081	4,509	4,818	5,101	5,261	5,283	5,105	4,743	4,302
	High growth						5,101	5,360	5,530	5,495	5,280	4,998
	Low growth						5,101	5,163	5,040	4,724	4,235	3,666
Population growth rate (%)	Medium growth	2.54	1.68	0.99	1.01	0.21	0.53	0.20	-0.12	-0.52	-0.89	-1.03
	High growth						0.53	0.46	0.15	-0.23	-0.50	-0.58
	Low growth						0.53	-0.06	-0.41	-0.85	-1.29	-1.54

2. Demographic variations (Birth, death and international migration)

- The number of births would drop from 430 thousand persons in 2015 to 360 thousand persons in 2035 and 260 thousand persons in 2065.
- Under the high growth scenario, the number of births would record 390 thousand persons in 2065.
- Under the low growth scenario, the number of births would record 160 thousand persons in 2065.
- The number of deaths would rise from 280 thousand persons in 2015 to over 400 thousand persons in 2028 and 740 thousand persons in 2065. The figure for 2065 is 2.7 times higher compared to 2015.
- Under the high scenario, the number of deaths would mark 760 thousand persons in 2065.

- Under the low scenario, the number of deaths would mark 720 thousand persons in 2065.
- The natural increase (Birth - Death) would be minus between 2022 and 2035.
- Under the medium assumption, the population growth is projected to begin recording a minus natural increase rate from 2029.
- Under the high assumption, the population growth is projected to begin recording a minus natural increase rate from 2035.
- Under the low assumption, the population growth is projected to begin recording a minus natural increase rate from 2022.
- The age of recording the highest number of deaths for both males and females is projected to rise by more than 8 years for the next 5 decades.
- The age of recording the highest number of deaths is projected to go up from 78 years for males and 85 years for females in 2015 to 90 years for males and 93 years for females in 2065. This figure rises by 12 years for males and 8 years for females.
- The number of net international migration would decrease from 80 thousand persons in 2015 to 30 thousand persons after 2030.
- Under the high scenario, the net international migration would decrease from 120 thousand persons in 2016 to 70~80 thousand persons after 2030.
- Under the low scenario, the net international migration would remain between - 10 thousand persons and 10 thousand persons after 2024.

[Table 2] Natural increase and net international migration (2015-2065)

(Unit: 10 thousand persons)

Classification	Scenario	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065
Population growth (=A+B)	Medium growth	23	15	9	2	-8	-19	-29	-38	-43	-44	-45
	High growth	23	26	24	17	6	-5	-15	-23	-27	-28	-30
	Low growth	23	4	-5	-13	-23	-33	-42	-50	-56	-57	-56
Natural increase (A)	Medium growth	15	9	4	-2	-12	-22	-32	-41	-46	-48	-48
	High growth	15	15	14	9	-1	-13	-22	-30	-34	-36	-37
	Low growth	15	2	-5	-12	-22	-32	-41	-50	-56	-57	-56
Birth	Medium growth	43	41	42	41	36	32	31	29	28	28	26
	High growth	43	46	50	49	44	40	39	39	40	41	39
	Low growth	43	36	34	33	29	25	23	21	19	17	16
Death	Medium growth	28	32	37	42	48	55	63	70	74	75	74
	High growth	28	31	35	40	46	53	61	69	75	77	76
	Low growth	28	34	40	45	50	57	65	71	75	75	72
International migration (B)	Medium growth	8	6	5	3	3	3	3	3	3	3	3
	High growth	8	11	10	8	8	8	8	7	7	7	7
	Low growth	8	2	1	-1	-1	-1	0	0	0	0	0

Note) Data between July of the reference year and June of the following year

- The drop in births and the rise in the aged population lead to the increase in deaths. The rise in deaths would bring about a continuous drop in the population after 2032. The plus net international migration is projected to reduce a decreasing trend in the total population.
- The population growth rate (-1.6 persons) during the 2035-2036 period stems from the natural increase rate of -2.2 persons and the net international migration of 0.6 person.

- The decrease in the population (-10,380 thousand persons) during the 2032-2065 period stems from the natural increase (Birth - Death, -11,520 thousand persons (111%) and plus net international migration (1,140 thousand persons, -11%).

[Table 3] Population growth rate by year and analysis of population growth

Scenario	Classification	Population growth rate (per 1,000 population)			Population growth (10 thousand persons) and contribution (%)			
		2016	2036	2066	2015-2031		2032-2065	
					Population	Contribution	Population	Contribution
Medium growth	Population growth (A-B+C)	4.5	-1.6	-10.4	194	100.0	-1,038	100.0
	Natural increase (A-B)	2.9	-2.2	-11.1	100	51.5	-1,152	111.0
	Birth (A)	8.4	6.9	6.1	702		1,040	
	Death (B)	5.4	9.1	17.2	602		2,192	
	Net international migration (C)	1.6	0.6	0.7	94	48.5	114	-11.0
High growth	Population growth (A-B+C)	4.5	1.1	-5.9	397	100.0	-530	100.0
	Natural increase (A-B)	2.9	-0.3	-7.3	231	58.1	-783	147.7
	Birth (A)	8.4	8.0	7.9	803		1,384	
	Death (B)	5.4	8.2	15.2	573		2,167	
	Net international migration (C)	1.6	1.4	1.4	166	41.9	253	-47.7
Low growth	Population growth (A-B+C)	4.5	-4.5	-15.4	-6	100.0	-1,486	100.0
	Natural increase (A-B)	2.9	-4.3	-15.4	-30	468.2	-1,472	99.1
	Birth (A)	8.4	5.7	4.4	605		753	
	Death (B)	5.4	10.0	19.8	635		2,225	
	Net international migration (C)	1.6	-0.2	0.0	23	-368.2	-14	0.9

Note) Population growth rate = Birth rate - Death rate + Net international migration rate

3. Population by age group

- As of 2015, the working age population aged 15 to 64 records 37,440 thousand persons, which accounts for 73.4 percent of the total population. The elderly population aged 65 or more records 6,540 thousand persons, which accounts for 12.8 percent of the total population. The child population aged 0 to 14 records 7,030 thousand persons, which accounts for 13.8 percent of the total population.
- In 2065, the working age population, the elderly population and the child population are projected to occupy 47.9 percent, 42.5 percent and 9.6 percent, respectively.
- The working age population is projected to decrease to 20,620 thousand persons (47.9%) in 2065 after recording a peak of 37,630 thousand persons in 2016.
- Under the high growth scenario, the working age population is projected to fall to 24,520 thousand persons (49.1%) in 2065 after recording a peak of 37,660 thousand persons in 2017.

- Under the low growth scenario, the working age population is projected to drop to 17,000 thousand persons (46.4%) in 2065 after recording a peak in 2016.
- Under all medium, high and low scenarios, the elderly population is projected to exceed the child population from 2017.
- Compared to 6,540 thousand persons (12.8%) in 2015, the elderly population is projected to rise by 2.3 times in 2035 and 2.8 times to 18,270 thousand persons (42.5%) in 2065.
- The super elderly population aged 85 or more is projected to increase from 510 thousand persons in 2015, exceeding 1,000 thousand persons in 2024. Compared to 2015, the super elderly population is projected to increase by 10 times to 5,050 thousand persons in 2065.
- The child population is projected to decrease to 7,030 thousand persons (13.8%) in 2015, 5,980 thousand persons (11.3%) in 2035 and 4,130 thousand persons (9.6%) in 2065.
- The school age population (people aged 6 to 21 years) is predicted to record 8,920 thousand persons in 2015, decreasing to 1,840 thousand persons for the next decade.

4. Median age

- The median age is predicted to mark 40.9 years in 2015, exceeding 50 years in 2033. This figure is predicted to rise to 59.0 years in 2061, falling to 58.7 years in 2065.
- According to both high and low assumptions, the median age is predicted to rise. Under the high assumption, the median age is expected to exceed 50 years in 2035, reaching 54.9 years in 2065.

[Table 4] Median age (1965-2065)

		(Unit: year)										
Classification	Sex	1965	1975	1985	1995	2005	2015	2025	2035	2045	2055	2065
Medium growth	Total	18.3	19.6	24.3	29.3	34.8	40.9	46.2	51.2	54.6	57.9	58.7
	Males	17.6	18.9	23.8	28.4	33.8	39.6	44.8	49.5	53.2	56.7	57.6
	Females	19.1	20.3	24.9	30.2	35.8	42.1	47.7	52.7	56.4	59.1	60.0
High growth	Total						40.9	45.8	50.1	53.2	55.8	54.9
	Males						39.6	44.5	48.4	51.8	54.6	53.7
	Females						42.1	47.3	51.9	54.8	57.1	56.1
Low growth	Total						40.9	46.5	52.1	56.1	59.8	62.4
	Males						39.6	45.1	50.5	54.6	58.7	61.3
	Females						42.1	48.0	53.5	57.9	61.0	63.5

5. Dependency ratio and aging index

- The total dependency ratio is projected to increase from 36.2 persons per 100 working age population in 2015, exceeding 70 persons in 2037. This figure is projected to exceed 100 persons in 2059.
- Under the high growth scenario, the total dependency ratio is projected to rise to 103.8 persons in 2065. Under the low growth scenario, the total dependency ratio is projected to rise to 115.6 persons in 2065.
- The child dependency ratio is projected to slightly rise from 18.8 persons in 2015 to 20.0 persons in 2065 as both the child population and the working age population drop.

- The aged dependency ratio is projected to rise from 17.5 persons in 2015, exceeding 50 persons in 2036. This figure will record 88.6 persons in 2065, which is 5.1 times higher than that for 2015.
- The ageing index (per 100 child population) is projected to exceed 100 persons in 2017 after recording 93.1 persons in 2015. The ageing index is projected to mark 203 persons in 2029 and 442.3 persons in 2065. The figure for 2065 is more than 4 times higher than that for 2015.

[Table 5] Dependency ratio and ageing index (1965-2065)

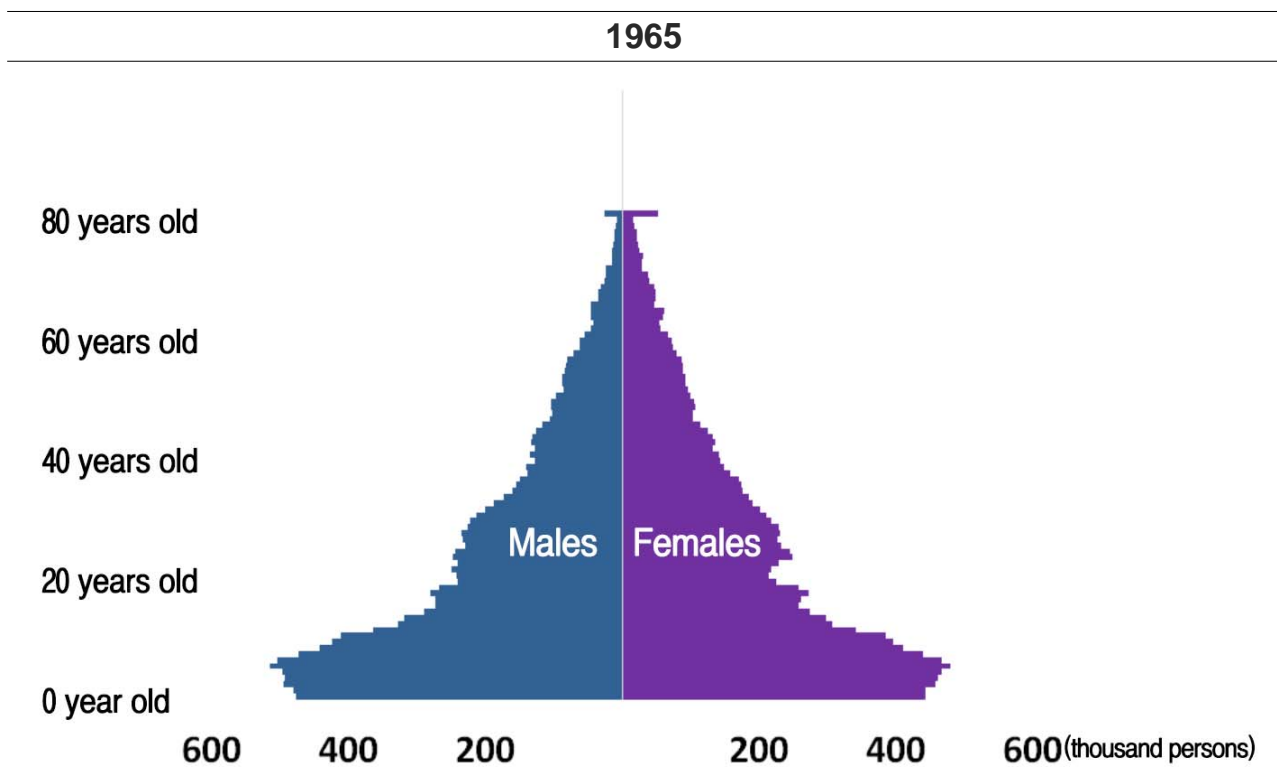
(Unit: per 100 working age population, per 100 child population)

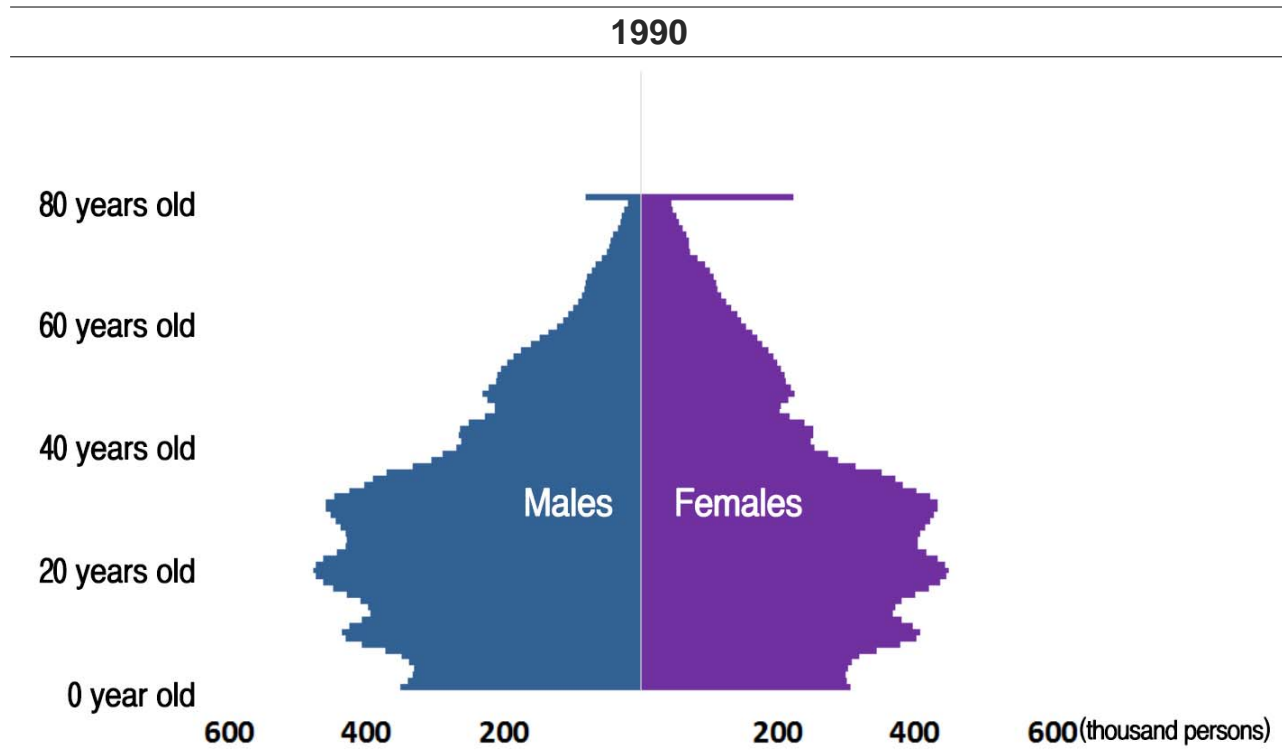
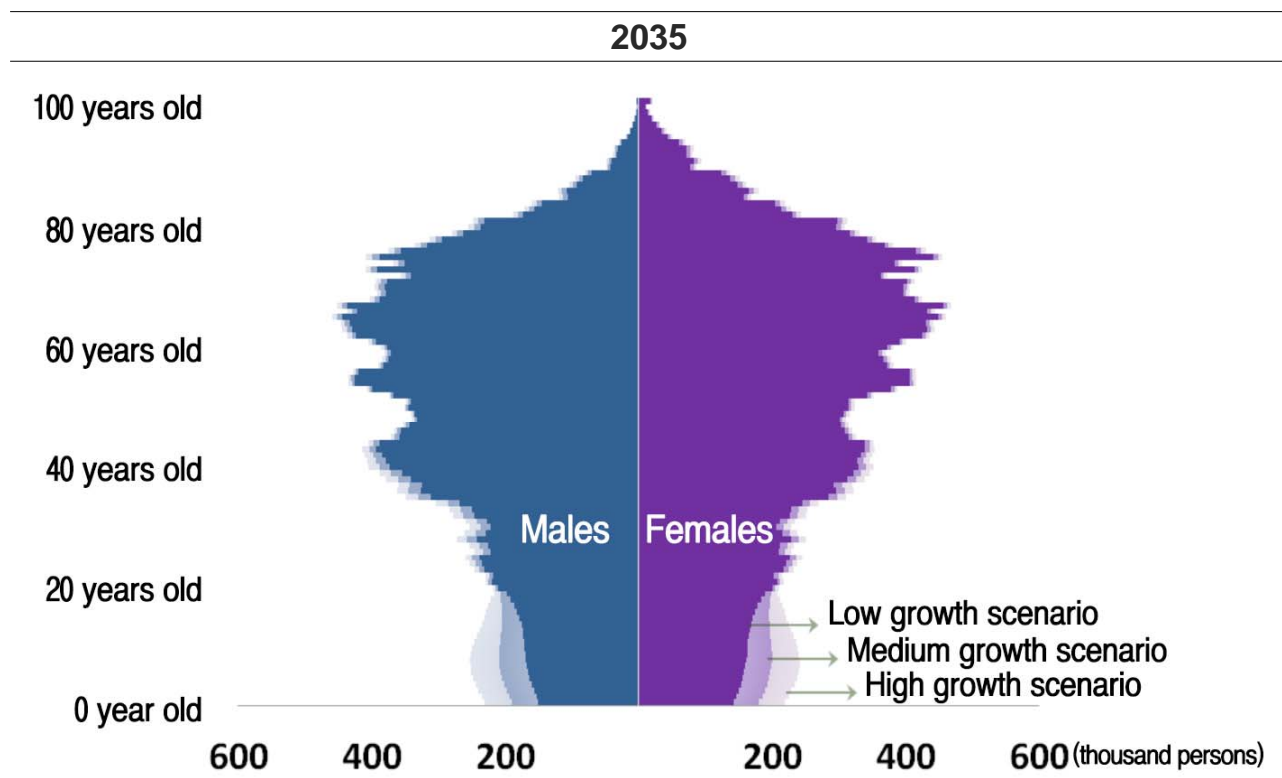
Scenario	Classification	1965	1975	1985	1995	2005	2015	2025	2035	2045	2055	2065
Medium growth	Total dependency ratio	88.3	72.5	52.5	41.4	39.1	36.2	47.1	66.8	84.2	94.2	108.7
	Child dependency ratio	82.5	66.6	46.0	33.0	26.6	18.8	17.8	18.9	18.6	18.2	20.0
	Aged	5.8	6.0	6.5	8.3	12.5	17.5	29.4	47.9	65.6	76.1	88.6
	Ageing index	7.0	8.9	14.2	25.2	46.8	93.1	165.6	253.7	352.7	418.8	442.3
High growth	Total dependency ratio						36.2	48.2	69.7	85.2	92.4	103.8
	Child dependency ratio						18.8	18.8	21.9	21.5	21.2	24.3
	Aged						17.5	29.4	47.7	63.7	71.2	79.5
	Ageing index						93.1	156.2	217.8	296.3	335.6	327.2
Low growth	Total dependency ratio						36.2	46.1	63.9	83.0	96.6	115.6
	Child dependency ratio						18.8	16.7	15.9	15.5	15.2	15.9
	Aged						17.5	29.4	48.0	67.4	81.5	99.7
	Ageing index						93.1	175.7	302.2	433.7	537.2	626.7

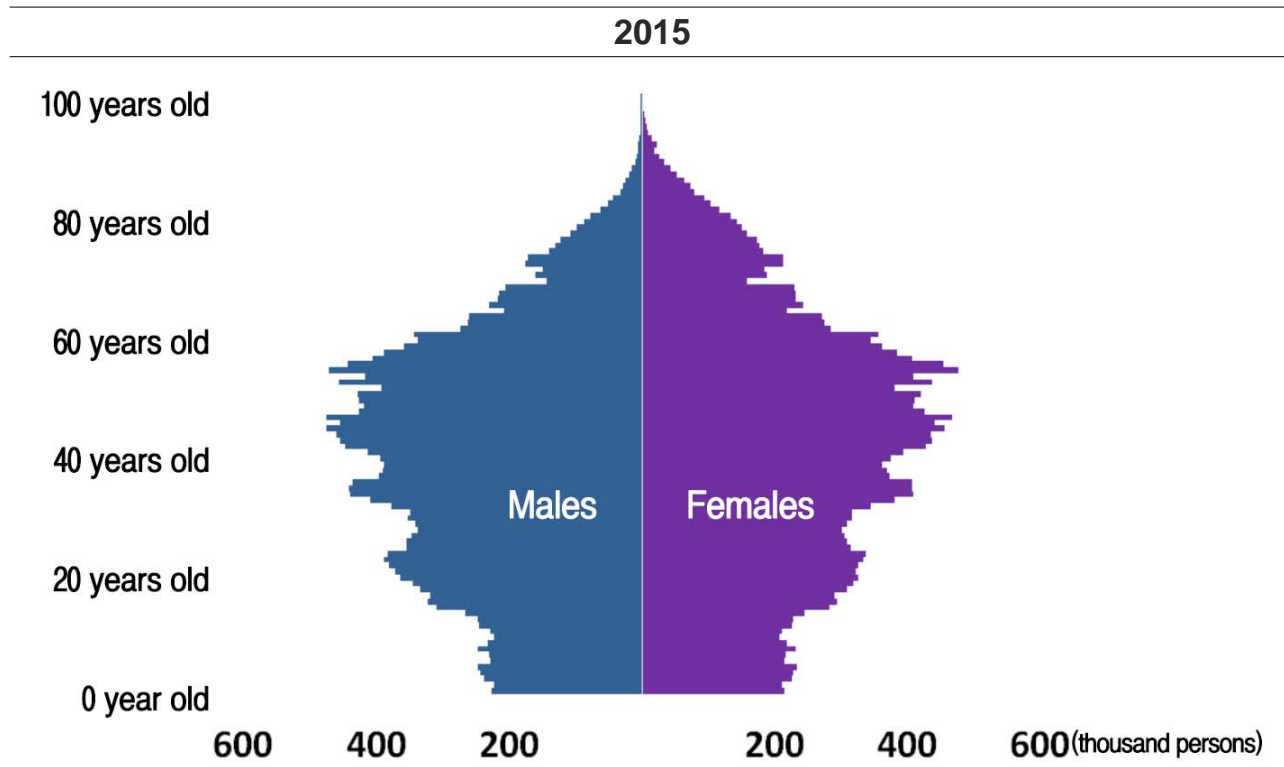
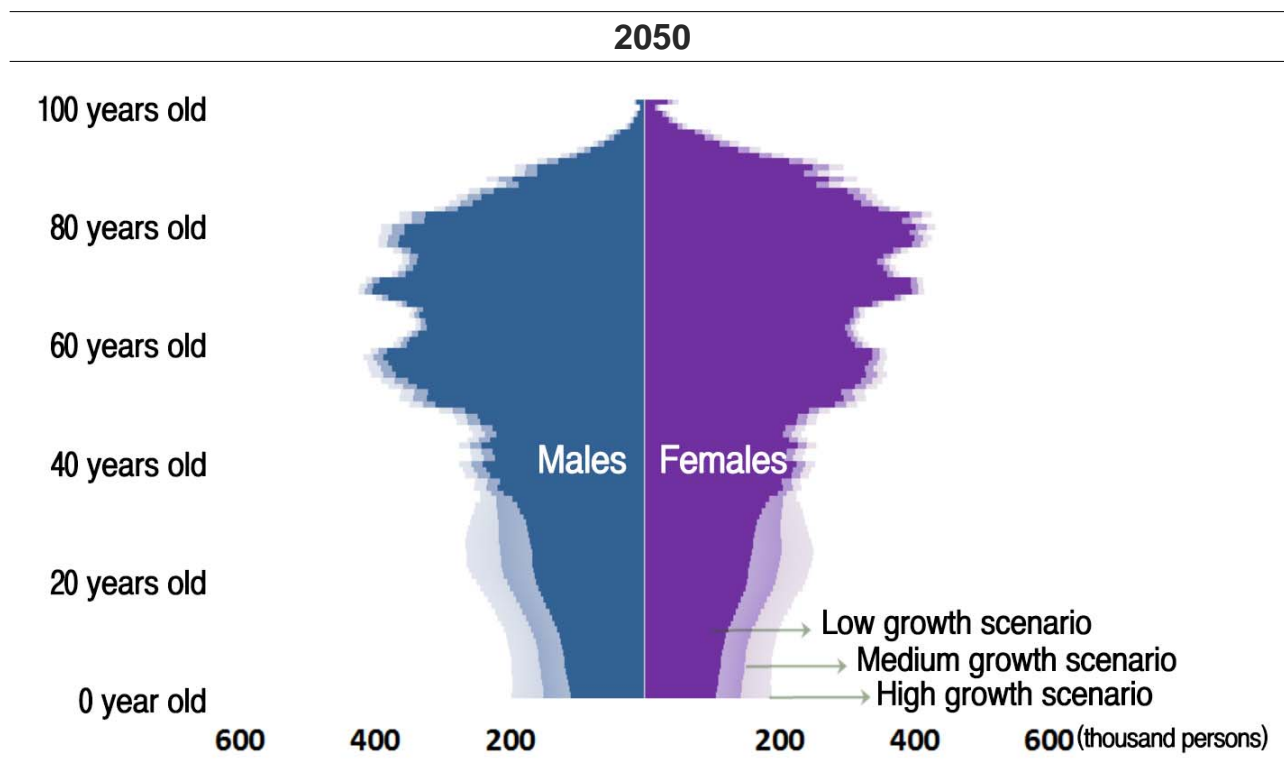
6. Population pyramid

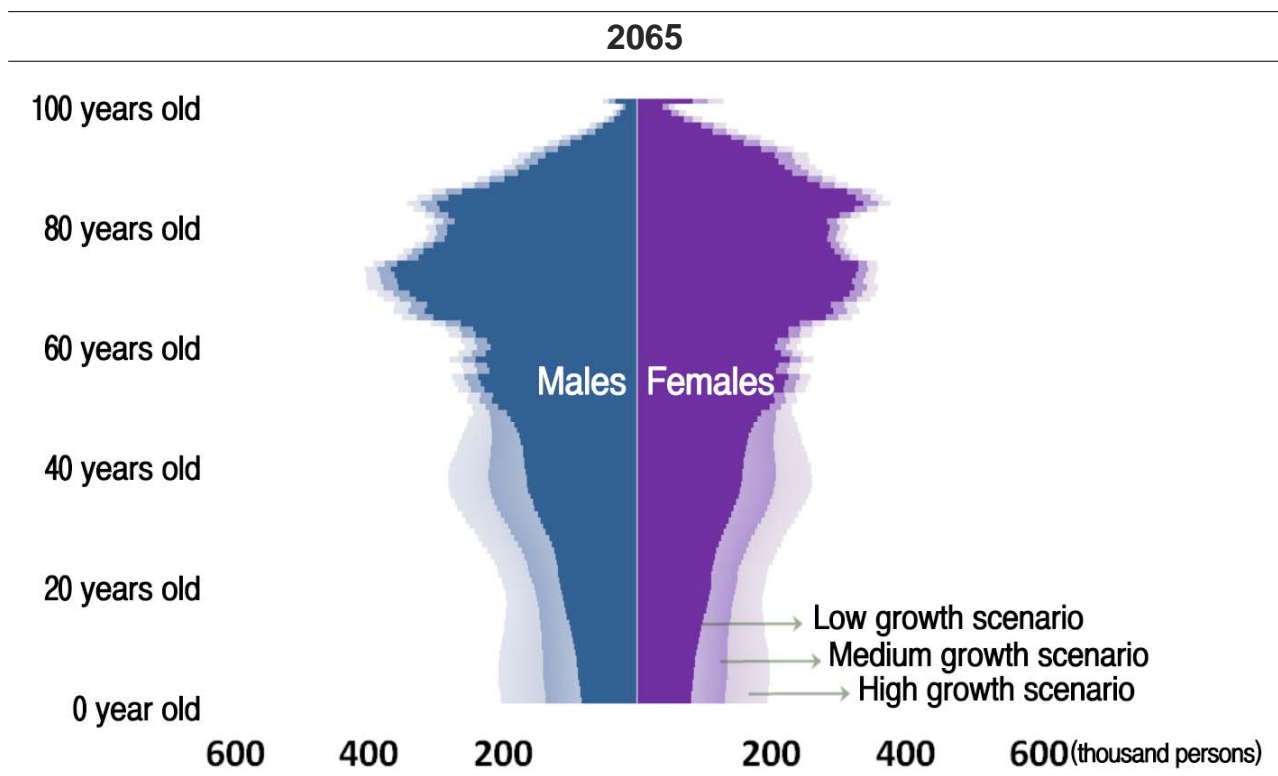
- As of 2015, the population pyramid is pot shaped due to a large share of people in their thirties ~ fifties. However, the population pyramid would become inverted triangular shaped due to a large share of people aged 60 or more.

[Figure 1] Population pyramid (1965-2065)









II. Method and assumptions

1. Cohort component method

- ☐ 『Population Projections for Korea (2015~2065)』 are based on the results of the 2015 Population Census, which is a register-based census. Statistics of births, deaths and international migration are used for population projections. According to the Cohort component method, the population size and the population structure by sex and age are projected from 2015 to 2065.
- ☐ According to the Cohort component method (birth, death and international migration), the population is projected by applying the demographic balancing equation. Births and net international migrations are added to the base population, while deaths are subtracted for population projections.

2. Base population (2015)

- ☐ The base population, which is a starting point for population projections, refers to the population as of July 1st, 2015.
- ☐ The base population (as of July 1st, 2015) is obtained by reflecting the demographic variations between July and October, 2015, on the basis of the census population as of November 1st, 2015 in the Population Census (Register-based Census).
- ☐ The base population (51,010 thousand persons, as of July 1st, 2015) was 60 thousand persons smaller than the census population (51,070 thousand persons, as of November 1st, 2015).

[Table 6] Census population and base population (2015)

2015	Population (10 thousand persons)		
	Total	Males	Females
Census population (November 1st)	5,107	2,561	2,546
Base population (July 1st)	5,101	2,559	2,543

3. Retrospective population (2001~2014)

- ☐ After finalizing the base population on the basis of the Population Census (Register-based Census) results, the retrospective population (estimated population between censuses) is calculated to determine the past population.
- ☐ In the meantime, to secure the stability of the time series in accordance with the switch to the register-based census, the retrospective period is extended from the usual 4 years to 14 years (2001~2014).
- ☐ The retrospective population is calculated by linearly distributing the estimation error¹⁾ of the current population²⁾ of 2015 by year and cohort to the current population from 2001 to 2014 (estimated population after the census).

4. Fertility projections

- ☐ Using the time series model, the cohort completed fertility rate is predicted. The birth rate by age is calculated by using generalized log gamma distribution.
- ☐ Fertility projections
 - By reflecting the uncertainty of future fertility rates, three assumptions are formulated.
 - 1) Under the medium fertility scenario, the total fertility rate would rise from 1.18 persons in 2016 to 1.38 persons in 2050. Afterwards, the figure would remain the same level.
 - 2) Under the high fertility scenario, the total fertility rate would rise from 1.20 persons in 2016 to 1.64 persons in 2050. Afterwards, the figure would remain the same level.
 - 3) Under the low fertility scenario, the total fertility rate would drop from 1.16 persons in 2016 to 1.12 persons in 2050. Afterwards, the figure would remain the same level.
 - A increasing trend of childbirth age gradually slows down and the fluctuation of birth rate is stabilized. In the long run, the birth rate and cohort birth rate are projected to reach the same level.

[Table 7] Total fertility rate (2015-2065)

(Unit: Number of births per woman aged 15 to 49)

		2015	2020	2025	2030	2035	2040	2050	2065
Total fertility rate	Medium growth	1.24	1.24	1.28	1.32	1.36	1.38	1.38	1.38
	High growth	1.24	1.38	1.50	1.57	1.62	1.64	1.64	1.64
	Low growth	1.24	1.10	1.07	1.07	1.10	1.12	1.12	1.12
Year-on-year change	Medium growth	0.03	0.01	0.01	0.04	0.04	0.02	0.00	0.00
	High growth	0.03	0.03	0.02	0.08	0.05	0.02	0.00	0.00
	Low growth	0.03	-0.01	0.00	0.00	0.03	0.02	0.00	0.00

1) Estimation error of 2015 = Base population of 2015 - Current population of 2015

2) Estimated population by considering observation values of demographic variations (birth, death, migration) to the base population of 2000.

- The feasibility of future fertility assumption is checked by referring to the opinion of external experts.
- Experts forecast that the total fertility rate will record 1.28 persons in 2025, 1.39 persons in 2040 and 1.46 persons in 2065.
- Compared to the future fertility rate of external experts, the future fertility of the KOSTAT for the 2016-2050 period is similar.

5. Mortality projections

- Mortality by sex and age is predicted by applying the Li-Lee-Gerland probability model (2013).³⁾
 - The Li-Lee-Gerland model⁴⁾ is applied to reflect the rotation of age pattern, which was a weak point of the Li-Lee model applied in mortality projections in 2011.
 - * By reflecting the slowing rate of improvement in the low-age mortality rate and the improvement in the high-age mortality rate, the Li-Lee-Gerland model was proposed in the '2016 Mortality Estimation Method Improvement Research Project'.
 - The death rates by sex and age between 1970 and 2016 are used as basic data.
 - * The number of deaths in 2016 is estimated by applying year-on-year percent changes in the number of deaths by age between January and September.
 - The high and low scenarios apply the 99% confidence interval of the Li-Lee-Gerland (LLG) model.
- Mortality projections
 - Three scenarios of life expectancy at birth are established by considering the uncertainty of future mortality.
 - 1) Under the medium mortality scenario, the life expectancy at birth of males would go up from 79.0 years in 2015 to 88.4 years in 2065. The life expectancy at birth of females would go up from 85.2 years in 2015 to 91.6 years in 2065.
 - 2) Under the high mortality scenario, the life expectancy at birth of males would go up to 89.2 years in 2065. The life expectancy at birth of females would go up to 92.6 years in 2065.
 - 3) Under the low mortality scenario, the life expectancy at birth of males would go up to 87.2 years in 2065. The life expectancy at birth of females would go up to 90.5 years in 2065.

3) Li, N., Lee, R., and Gerland, P.(2013), "Extending the Lee-Carter method to model the rotation of age pattern of mortality decline for long-term projections", *Demography*, 50(6), 2037-2051.

4) The Li-Lee model, a kind of Lee-Carter (LC) model widely used in the world, complements the coherence of the group-to-group mortality estimation, which is a weak point of the LC model. The Li-Lee model reflects common trends of death rates of males and females as well as individual trends of the death rates by sex.

[Table 8] Life expectancy at birth (2015-2065)

(Unit: year)

		2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065
Medium growth	Total	82.1	83.2	84.3	85.2	86.1	86.9	87.6	88.3	88.9	89.5	90.0
	Males	79.0	80.3	81.6	82.7	83.7	84.7	85.5	86.3	87.1	87.8	88.4
	Females	85.2	86.2	87.0	87.8	88.5	89.1	89.7	90.2	90.7	91.2	91.6
High growth	Total	82.1	83.8	85.0	86.1	87.0	87.8	88.6	89.2	89.9	90.4	90.9
	Males	79.0	80.9	82.3	83.6	84.7	85.6	86.5	87.2	88.0	88.7	89.2
	Females	85.2	86.7	87.7	88.6	89.4	90.0	90.7	91.2	91.7	92.1	92.6
Low growth	Total	82.1	82.6	83.4	84.2	85.1	85.7	86.5	87.2	87.7	88.3	88.8
	Males	79.0	79.6	80.6	81.7	82.7	83.6	84.4	85.2	85.9	86.6	87.2
	Females	85.2	85.5	86.1	86.8	87.4	87.9	88.5	89.1	89.6	90.0	90.5

6. International migration projections

- International migrations of Koreans and foreigners are separately projected to reflect their different characteristics.
- By considering a stable net international migration rate of Koreans, the average net international migration rate by sex and age for the recent five years is applied.
 - The age-specific high and low scenarios apply the 99% confidence interval.
- When calculating the international migration rate of foreigners, it's difficult to define the population used as a denominator. By considering the characteristics of foreigner policies that are managed in terms of size, such as the quota system by status of sojourn, the net migration by year is used.
 - After estimating the total net migration by period, the figure is distributed by sex and age.
 - The total net migration of foreigners is based on the projection of foreigners by year according to the '2nd Basic Plan for Foreigners' (Ministry of Justice).
- Results of international migration projections
 - Three scenarios are established by considering the uncertainty of net international migration in the future.
 - 1) Under the medium migration scenario, the net international migration would fall from 81 thousand persons in 2015 to 64 thousand persons in 2020, 33 thousand persons in 2030 and 32 thousand persons in 2065.
 - 2) Under the high migration scenario, the net international migration would fall from 111 thousand persons in 2020 to 76 thousand persons in 2030 and 71 thousand persons in 2065.
 - 3) Under the low migration scenario, the net international migration would fall from 19 thousand persons in 2020 to -9 thousand persons in 2030 and -2 thousand persons in 2065.

7. Population projection scenarios

- The three assumptions of the high growth, medium growth and low growth scenarios are established by considering components of demographic variations (birth, death and international migration) to reflect future uncertainty into a total of 30 projection scenarios.

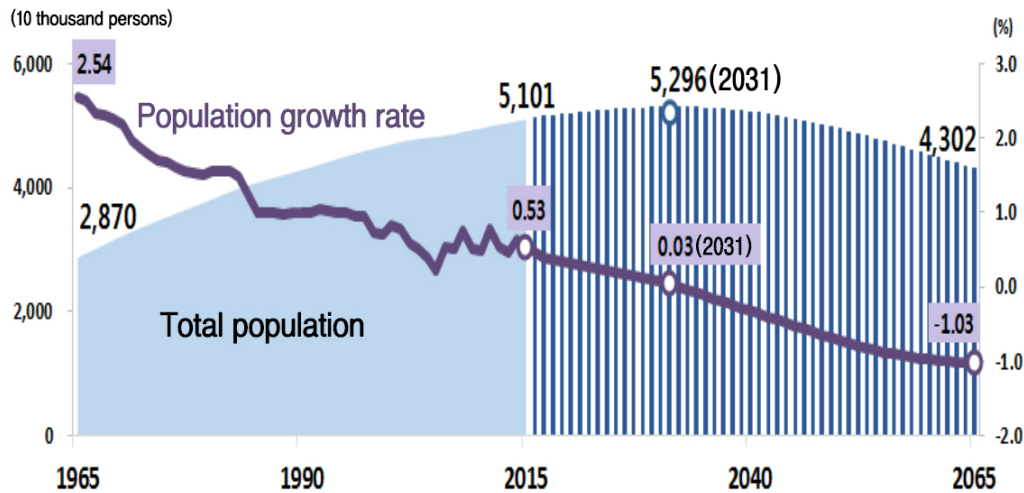
- A combination of all the assumptions leads to 27 scenarios (3 assumptions of birth x 3 assumptions of death x 3 assumptions of international migration).
 - As basic scenarios, the medium assumption is formulated by combining the medium assumptions of birth, death and international migration. The high assumption (maximum population size) is formulated by combining the high assumptions of birth, death and international migration. The low assumption (minimum population size) is formulated by combining the low assumptions of birth, death and international migration.
- Three special scenarios are added by considering foreigner policy and childbirth policy.
 - The zero international migration scenario is assumed to eliminate the effect of international migration which is easily affected by policy factors. (medium assumption of birth rate and life expectancy at birth)
 - The scenario of the current birth rate assumes that the average birth rate for the recent five years will be maintained. (medium assumption of life expectancy at birth and international migration)
 - The scenario of the target birth rate assumes that according to the 3rd Basic Plan for low birth and aging society, the target birth rate for 2017~2020 will be realized. (medium assumption of life expectancy at birth and international migration) (The total fertility rate would be 1.5 persons after 2021.)
- Excluding three basic scenarios (medium growth, maximum growth and minimum growth), the other 27 scenarios are provided on the KOSIS website.

[Table 9] Population projection scenarios and projection results

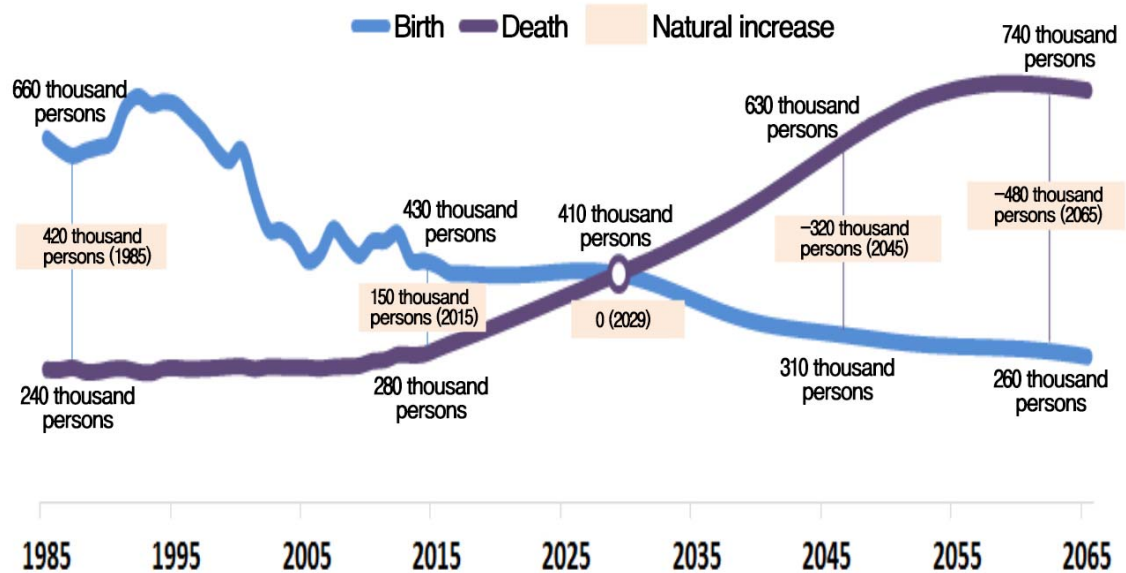
Indicator		High growth	Medium growth	Low growth	Zero international migration, birth (medium) + death (medium)
Total fertility rate (person)	2015		1.24		
	2050	1.64	1.38	1.12	1.38
Life expectancy at birth (year)	2015		79.0 / 85.2		
	2065	89.2 / 92.6	88.4 / 91.6	87.2 / 90.5	88.4 / 91.6
Net international migration (thousand persons)	2015		81		
	2065	71	32	-2	0
Total population and growth rate (thousand persons, %)	2015		51,015 (0.53)		
	2065	49,977 (-0.58)	43,024 (-1.03)	36,659 (-1.54)	40,918 (-1.15)
	Population peak (year)	55,420 (2038)	52,958 (2031)	51,680 (2023)	52,069 (2028)
Population aged 15~64 and share (thousand persons, %)	2015		37,444 (73.4%)		
	2065	24,518 (49.1%)	20,620 (47.9%)	17,003 (46.4%)	19,452 (47.5%)
	Population peak (year)	37,663 (2017)	37,627 (2016)	37,627 (2016)	37,627 (2016)
Population aged 65 or more and share (thousand persons, %)	2015		6,541 (12.8%)		
	2065	19,498 (39.0%)	18,273 (42.5%)	16,951 (46.2%)	17,434 (42.6%)
Population aged 0 ~ 14 and share (thousand persons, %)	2015		7,030 (13.8%)		
	2065	5,960 (11.9%)	4,132 (9.6%)	2,705 (7.4%)	4,032 (9.9%)
Total dependency ratio and aged dependency ratio (per 100 working age population)	2015		36.2 (17.5)		
	2065	103.8 (79.5)	108.7 (88.6)	115.6 (99.7)	110.4 (89.6)

[Population Projections (2015~2065)]

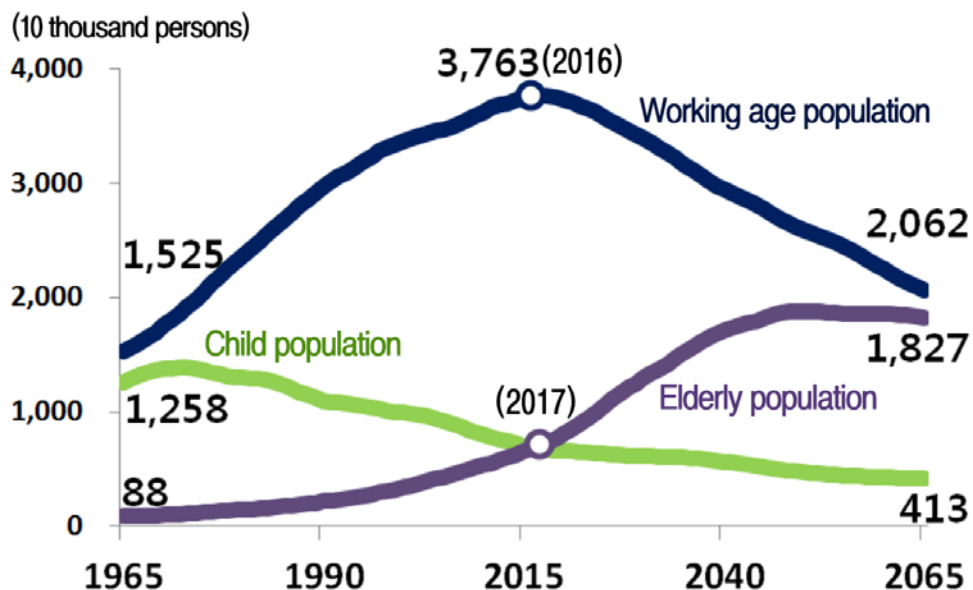
Total population and population growth rate (1965~2065)



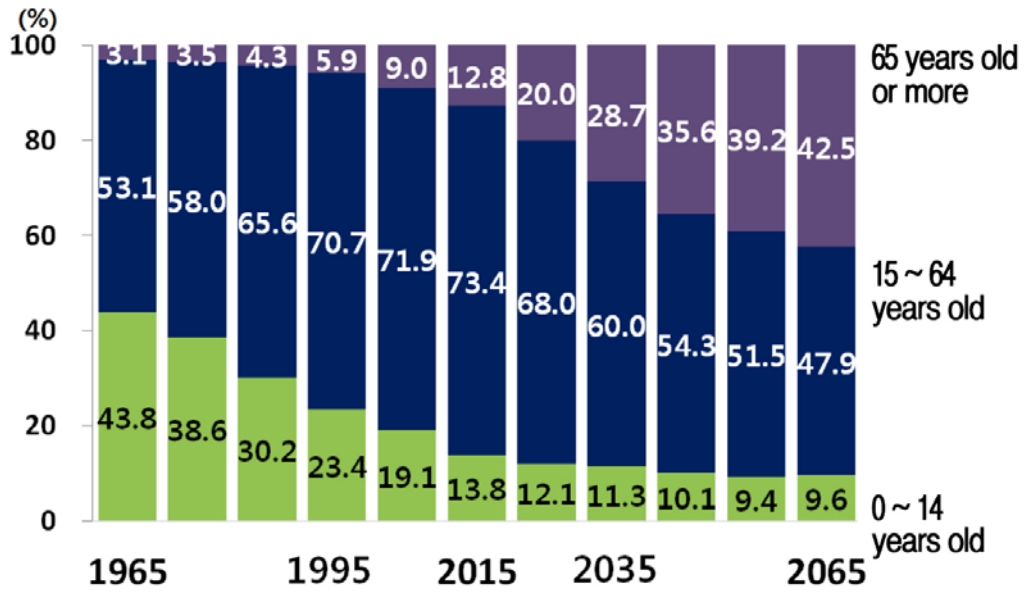
Number of births and deaths (1985~2065)



Population structure by age group (1965~2065)



Composition of the population by age group (1965~2065)



Working age population (1965~2065)

(10 thousand persons)

