

AN APPRAISAL OF HONG KONG POPULATION PROJECTIONS

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In the past two decades the Hong Kong Government prepared five sets of projections on Hong Kong's population size and structure. The first projection for 1961-1971 was made in 1963 on the basis of the demographic data gathered during the 1961 Population Census and the vital and migration statistics existing at that time. The second set of projected population figures for 1966-1981 was based on the results obtained from the 1966 By-Census, and the third set of projections for 1971-1991 was prepared in 1973 from the results of the 1971 Census and the vital and migration statistics of the 1960's.¹ The fourth set was based on the demographic statistics derived from the 1976 By-Census and was projected to cover twenty years between 1976 and 1996.² The fifth set was published in 1982³ for the period 1981-2001 and was based on the 1981 Census data and up-to-date information on fertility, mortality and migration.

The Component method was followed in preparing these population projections. Based on the existing vital and migration statistics, various assumptions on the course of mortality, fertility and migration were made to derive separate estimates of both sexes in each age group of the population. In stating explicitly the assumptions regarding the components of population growth, the component method can reveal "considerable insight into the way population changes".⁴ The first four sets of projections were prepared at three levels, that is high, medium and low projections, except that in the 1966-1981 projections the medium projection was further divided into three sub-levels. The fifth set of projections were based on only one set of assumptions on the demographic variables.

This paper intends to discuss the formulation of these assumptions and the preparation of the projections, to analyse the improvements in the techniques used, and to examine the accuracy of the projection results.

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The Projections for 1961-1971

The 1961 Census, which was carried out on February 11, 1961 for the marine population and on March 7, 1961 for the land population, recorded the total number of the Hong Kong Population to be 3,129,648 residents and 3,483 transients. The first step in preparing the projections was to estimate the population of Hong Kong on July 1, 1961 to be used as the base population for the projections. In arriving at this estimate, the Marine Census figures were in the first place adjusted to the date of the Land Census and added to the Land Census figures, then the totals for each individual age were further adjusted to reach the estimated population total for July 1, 1961 by "adding all the registered births, deducting all the registered deaths and adding the estimated numbers of immigrants", and finally the age distribution thus obtained was modified by graduation "to avoid distorting the dip in the age distribution represented by the Pacific War generation".⁵ Table 1 below shows the age and sex distribution of Hong Kong's 1961 Census population and the adjusted figures for July 1, 1961.

The crude death rate of Hong Kong fell from about 10 per thousand in the late 1940's to below 6 per thousand in 1961, and the infant mortality rate declined from around 100 per thousand to below 40 per thousand. This rapid decline was largely due to "the massive extension of medical facilities for the poor and the improvement of standards of living and environmental sanitation".⁶ The quinquennial age-specific death rates for males and for females computed for the years 1956 to 1961 showed a decline of between 15% and 50% for all groups up to 50 years of age. The death rates tended to increase for older people during this period. An exponential trend fitted to mortality indices, obtained from computing the weighted average age-specific death rate for each of the six years 1956-1961 with weights showing the ratio of population in each age group to the total population, could be represented by the equation $PV^{0.279} = 132.9$ where P is the mortality index and V represents the years with 1956 as 1.

Three sets of estimates with different assumptions on mortality, fertility and migration trends were prepared in the first projections. In the high and medium projections the age-specific mortality rates were assumed to continue until 1971 the decreasing trend along the exponential curve $PV^{0.279} = 132.9$. This would mean that the 1966 age-specific death rates were assumed to be 15.5% below the 1961 level and the 1971 age-specific death rates 24% below the 1961 level. In the low projections, the 1961 mortality rates were assumed to remain unchanged till 1971.

Table 1 Age and Sex Distribution of Hong Kong Population
(1961)

Age Group	Population Enumerated in the 1961 Census		Adjusted Population on July 1, 1961	
	Males	Females	Males	Females
0 — 4	257,699	243,006	267,100	252,000
5 — 9	220,477	204,965	226,400	210,300
10 — 14	185,910	165,129	183,200	163,100
15 — 19	90,400	74,922	96,700	80,500
20 — 24	111,466	91,549	111,400	90,900
25 — 29	137,558	116,843	141,100	119,200
30 — 34	141,335	122,398	141,100	122,800
35 — 39	123,741	111,724	125,900	113,400
40 — 44	107,746	95,803	107,000	96,400
45 — 49	86,826	80,746	87,400	81,500
50 — 54	60,344	63,840	60,800	64,800
55 — 59	37,392	49,835	38,300	51,000
60 — 64	23,707	40,047	23,500	39,600
65 — 69	13,256	27,838	13,400	28,300
70 — 74	7,579	18,501	7,500	18,400
75 — 79	3,470	9,872	3,600	10,100
80 — 84	1,428	4,064	1,400	4,100
85+	477	1,550	500	1,600
Total	1,610,811	1,522,632	1,636,300	1,548,000

Source: *Population Projections for Hong Kong, 1961-1971, Census and Statistics Department, Hong Kong, 1963, p. 3.*

Table 2 shows the 1961 age-specific death rates and the projected age-specific death rates for 1964 and 1969.

Table 2 Projected Age-Specific Death Rates for High and Medium Projections
(1964 and 1969)

Age Group	Age-Specific Death Rates, 1961		Projected Age-Specific Death Rates			
			1964		1969	
	Male	Female	Male	Female	Male	Female
0 - 4	12.00	10.70	10.90	9.72	9.59	8.55
5 - 9	0.96	0.82	0.88	0.75	0.77	0.66
10 - 14	0.66	0.46	0.60	0.42	0.53	0.37
15 - 19	0.75	0.67	0.69	0.61	0.60	0.54
20 - 24	1.29	0.81	1.17	0.74	1.03	0.65
25 - 29	1.55	1.27	1.41	1.15	1.24	1.01
30 - 34	2.20	1.59	2.00	1.44	1.76	1.27
35 - 39	3.04	2.17	2.76	1.97	2.43	1.73
40 - 44	4.84	3.09	4.40	2.81	3.87	2.47
45 - 49	7.41	4.21	6.73	3.82	5.92	3.36
50 - 54	14.14	6.99	12.85	6.35	11.30	5.59
55 - 59	19.84	9.14	18.02	8.30	15.86	7.30
60 - 64	38.17	15.51	34.67	14.09	30.50	12.39
65 - 69	47.68	20.21	43.31	18.36	38.10	16.15
70 - 74	77.33	37.99	70.23	34.50	61.79	30.35
75 - 79	101.39	61.68	92.08	56.02	81.01	49.29
80 - 84	165.00	95.61	149.85	86.83	131.84	76.39
85+	216.00	196.87	196.17	178.80	172.58	157.30

Note: The 1961 rates were mid-year rates, and the projected figures were rates for the beginning of 1964 and 1969 respectively.

Source: *Population Projections for Hong Kong, 1961-1971, Census and Statistics Department, Hong Kong, 1963, p. 14.*

The age-specific birth rates showed increases in the three quinquennial groups below 30 years of age, but recorded decreases in the other three quinquennial groups for ages 30 and up during the period 1956-1961. Except for the age group 20-24, of which the birth rate rose from 271 per 1,000 in 1956 to 352 per 1,000 in 1961, the changes in other age-specific birth rates were not great.⁷ The general fertility rate was computed to be 174.46 for 1961 with fluctuations between 170 and 180 during this period.⁸ Factors which might have an effect on the fertility rate included improved medical services and housing conditions, the tendency towards later marriage, and the introduction of family planning program during this period.

The high projection assumed a slight increase of one per cent per annum in the fertility rate up to 1971. The medium projection assumed the fertility rate would remain unchanged at the 1961 level, and the low projection assumed a decrease of one per cent per annum in the fertility rate. Table 3 summarizes the projected age-specific birth rates of the high, medium and low projections.

Table 3 Projected Age-Specific Birth Rates
(1961 - 1971)

Age Group	Age-Specific Birth Rates, 1961	Projected Age-Specific Birth Rates			
		1961 - 1966		1966 - 1971	
		High	Low	High	Low
15 - 19	61.1	62.7	59.6	65.9	56.7
20 - 24	351.8	360.8	343.2	379.2	326.4
25 - 29	297.2	304.8	289.9	320.4	275.7
30 - 34	180.3	184.9	175.9	194.4	167.3
35 - 39	104.1	106.8	101.6	112.2	96.6
40 - 44	25.5	26.2	24.9	27.5	23.7

Source: *Population Projections for Hong Kong, 1961-1971, Census and Statistics Department, Hong Kong, 1963, p. 15.*

During that period over one million persons left Hong Kong each year and a slightly larger number of people entered. The estimated average annual increase in the population due to migration was around 61,100 persons between April 1955 and March 1960. The annual increases fluctuated between 20,000 and 80,000.⁹ The information on those not born in Hong Kong collected in the 1961 Census showed that among the 316,000 persons with less than six years residence in Hong Kong 25 per cent were in the age group 10-19, 28 per cent between 20-29 and another 28 per cent between 30-39.

Table 4 The Estimated Age and Sex Distribution
of the Net Increase by Migration
(Percentages)

Age Group	Male	Female
0 — 4	1.86	1.56
5 — 9	4.86	3.60
10 — 14	6.90	5.22
15 — 19	8.06	5.67
20 — 24	8.48	5.73
25 — 29	6.73	5.57
30 — 34	3.65	4.90
35 — 39	2.66	4.01
40 — 44	1.97	3.27
45 — 49	1.46	2.85
50 — 54	1.06	1.55
55 — 59	0.75	2.27
60 — 64	0.50	1.77
65 — 69	0.32	0.95
70 — 74	0.17	0.47
75+	0.07	0.11
Total	49.50	50.50

Source: *Population Projections for Hong Kong, 1961-1971, Census and Statistics Department, Hong Kong, 1963, p. 13.*

Regarding the effects of migration, a net gain of 122,000 persons was assumed for 1962. The high projection assumed a net annual gain of 80,000 persons by migration for the period mid-1962 to mid-1971, and the medium and the low projections assumed a net gain of 50,000 persons and 20,000 persons every year respectively. Furthermore, the age and sex distribution of the net increase by migration in the 1960's was assumed in the projections to follow the similar pattern estimated from information on recent arrivals gathered in the 1961 Census.¹⁰

Based on the various assumptions at three different levels discussed above, the population of Hong Kong was projected to be between a low of 3.82 million persons and a high of 4.13 million persons for 1966 and between 4.39 million and 5.22 million for 1971.

Table 5 The Projected Population of Hong Kong
(1966 and 1971)

Level of Projection	Mid-1966	Mid-1971
High	4,131,900	5,217,700
Medium	3,982,100	4,812,700
Low	3,824,900	4,388,700

Source: Population Projections for Hong Kong, 1961-1971, Census and Statistics Department, Hong Kong, 1963, p. 15.

In fact it turned out later that the low projection figure of 3.82 million persons for 1966 was about 100,000 persons more than the estimated mid-year population for the same year found later and the low projected 1971 population of 4.39 million was 343,000 persons more than the mid-1971 population.

For those aged under 10 years old, the difference between the low projected mid-1971 population and the estimated mid-1971 population was 170,300, which accounted for half of the overall difference. This was 170,300, which accounted for half of the overall difference. This was due to the faster decline in the number of live births in the 1960's than as projected. The decrease in women of child-bearing age and decrease in fertility contributed to the decline in birth rate. For those aged 60 years and over, the estimated proportion was marginally higher than

the projected population in mid-1971. The discrepancy was due to the continued decline in mortality. The over-estimated net gain from migration contributed to the remaining discrepancy.

Table 6 Age and Sex Distribution of Hong Kong Population
(Mid-1971, in thousands)

Age Group	1961-1971 Projection Low Projection		Adjusted mid-1971 Population*	
	Males	Females	Males	Females
0-9	564.4	526.6	472.0	448.7
10-19	518.5	480.6	499.1	474.7
20-29	324.8	275.6	293.9	259.8
30-39	281.8	238.7	248.3	212.7
40-49	271.1	252.8	251.1	232.2
50-59	182.4	184.4	178.0	173.5
60-69	78.8	114.0	83.1	111.5
70+	24.9	69.3	31.7	75.0
Total	2,246.7	2,142.0	2,057.2	1,988.1

*Revised based on 1971 Census results on age and sex distribution.

Source: *Population Projections for Hong Kong, 1961-1971, Census and Statistics Department, Hong Kong, p. 16.*

The Projections for 1966-1981

A mid-term By-Census was taken by samples in 1966.¹¹ The By-Census date was June 19, 1966 for the boat population or August 2, 1966 for the land population. The By-Census population total computed from the sample was 3,716,400, with a 95 per cent accuracy range from 3,609,200 to 3,823,600.

The Population projection for 1966-1981 was worked out based on the 1966 By-Census results and the changing vital statistics. Firstly, the 1966 By-Census

population figures were adjusted to July 1, 1966. The sex and age distribution of the 1966 By-Census population and the adjusted population after graduation are shown in Table 7.

Table 7 Age and Sex Distribution of Hong Kong Population
(1966)

Age Group		Population Estimated in the 1966 By-Census*		Adjusted Population on July 1, 1966	
		Males	Females	Males	Females
0	4	261,150	249,470	274,100	259,100
5	9	275,190	253,810	275,100	253,200
10	14	233,630	214,760	233,600	214,800
15	19	204,000	180,340	204,100	181,200
20	24	106,770	93,990	106,900	94,200
25	29	112,870	97,260	114,200	97,100
30	34	129,390	114,980	129,200	115,800
35	39	132,540	127,440	132,100	127,900
40	44	118,840	115,800	118,600	115,000
45	49	98,090	93,310	98,300	93,700
50	54	82,490	82,690	83,400	82,500
55	59	54,160	64,000	53,100	63,500
60	64	35,460	55,050	35,400	55,100
65	69	18,620	38,340	18,200	38,700
70	74	11,040	26,950	11,300	26,600
75	79	4,030	12,880	3,900	12,900
80+		2,600	6,980	2,600	7,000
Total		1,880,870	1,828,050	1,894,100	1,838,300

*Confined to those living in households or in certain descriptions of household.

Source: Report of the By-Census, 1966, and Hong Kong Population Projections, 1966-1981, Census and Statistics Department, Hong Kong, 1968.

The vital and migration statistics available for this period showed that the crude death rate continued to decline from 6 per thousand in 1961 to slightly over 5 per thousand in 1966. The exponential function fitted to the mortality indices derived from the age-specific death rates for 1956-1965 was of the form $PV^{0.222} = 126.5$, implying a 13 per cent decrease in the mortality level between 1961 and 1966. The crude birth rate decreased from over 35 per thousand to below 26 per thousand during this period. The age-specific birth rates obtained in 1966 from a sample survey of birth records were 23, 228, 260, 194, 127 and 60 for the six quinquennial age groups 15-19, 20-24, . . . , 40-44, respectively. The first three rates were smaller and the last three were larger than the corresponding age-specific birth rates obtained in 1961. The median number of children for ever-married women in age groups over 30 was found from the 1966 By-Census results to be increasing. The balance of migration from 1961-1967 was estimated to vary between a net loss of 14,500 persons a year to a net gain of 18,500 persons a year, except for the year 1962 during which immigration exceeded emigration by about 135,000 persons. From the information collected in the By-Census,¹² it was estimated that nearly 55 per cent of the new arrivals were males and 45 per cent females. About 28 per cent of the balance of migration were below 15 years of age, 63 per cent between 15 and 54, and the other 9 per cent were older persons of 55 years old and above.

The projections for 1966-1981 were again prepared at three levels, with the medium projection further divided into three groups. The assumptions on mortality, fertility and migration trends for these projections are summarized in Table 8.

The projected population figures thus obtained varied from 4,106,600 persons by low projection to 4,286,900 persons by high projection for 1971, and from 4,934,300 persons by low projection to 5,705,500 persons by high projection for 1981.

The high projection figure of 4,286,900 persons for 1971 obtained from this set of projections was 100,000 persons less than the previous low projection figure for 1971 based on the 1961 Census data, and the difference between the low projection and the estimated mid-1971 population size decreased to around 60,000 persons, about one and a half per cent of the population. The projected Hong Kong population at Medium II level for the year 1981 was fairly close to the mid-1981 population of 5,133,800. The difference was only 11,700 persons.

The proportion of the young generation, those below 15 years of age, projected by the medium II level for mid-1981 was 33 per cent, and the estimated proportion in mid-1981 was 25 per cent, a difference of 413,000 persons. As for the proportion

Table 8 Mortality, Fertility and Migration Trends
Assumed in the 1966-1981 Projections

Projection Level	Mortality	Fertility	Migration
High	To decline along the exponential curve $PV^{0.222} = 126.5$	Age-specific birth rates to remain at the 1966 level	A net gain of 20,000 persons a year
Medium 1	To decline along the exponential curve $PV^{0.222} = 126.5$	10% decrease every 5 years for age group 15-29 and 2% increase for age group 30-44	A net gain of 10,000 persons a year
Medium 2	To remain at the 1966 level	10% decrease every 5 years for age group 15-29 and no change for age group 30-44	A net gain of 5,000 persons a year
Medium 3	To remain at the 1966 level	10% decrease every 5 years for age group 15-29 and 2% decrease for age group 30-44	A net gain of 2,000 persons a year
Low	To remain at the 1966 level	10% decrease every 5 years for all age group	No gain

Source: Summarized from *Hong Kong Population Projections, 1966-1981*, Census and Statistics Department, Hong Kong, 1968.

Table 9 The Projected Population of Hong Kong
(1971 and 1981)

Level of Projection	Mid-1971	Mid-1981
High	4,286,900	5,705,500
Medium 1	4,208,000	5,329,700
Medium 2	4,159,700	5,145,100
Medium 3	4,135,600	5,060,900
Low	4,106,600	4,934,300

Source: *Hong Kong Population Projections, 1966-1981, Census and Statistics Department, Hong Kong, 1968.*

of working population, those aged 15 years to 64 years, the projected figure was 62 per cent and the estimated was 69 per cent in mid-1981, a difference of 353,200 persons. The continued decline in fertility in the period 1966-1981 resulted in a smaller proportion of youth in the mid-1981 population than the projected proportion which was made in 1966. The influx of Chinese immigrants, particularly in the late 1970's, who were young and mainly males, contributed to the higher proportion of working population and altered the sex structure of the local population, from the projected 1031 to the estimated 1094 in mid-1981.

Table 10 Age and Sex Distribution of Hong Kong Population
(Mid-1981, in thousands)

Age Group	1966-1981 Projection Medium Projection II		Adjusted Mid-1981 Population*	
	Males	Females	Males	Females
0 - 9	612.9	578.8	426.6	396.7
10 - 19	523.8	494.7	522.8	486.7
20 - 29	510.6	470.3	583.6	515.2
30 - 39	314.0	278.1	331.0	295.2
40 - 49	239.3	210.8	291.3	233.7
50 - 59	225.8	230.8	254.2	229.3
60+	185.0	270.2	232.4	295.1
Total	2,611.4	2,533.7	2,681.9	2,451.9

*Revised based on 1981 Census results on age and sex distribution.

Source: *Hong Kong Population Projections, 1966-1981, Census and Statistics Department, Hong Kong, 1968, p. 8.*

The Projections for 1971-1991

The 1971 Census, which took place on February 23, 1971 for persons living afloat in small boats, and March 9, 1971 for land population, returned the total number of the Hong Kong Population at 3,936,630 persons¹³, showing an increase of 26 per cent or 800,000 persons over the 1961 Census total. This population total was 350,000 persons below the high projection or 170,000 persons below the low projection based on the 1966 By-Census results.

Hong Kong's crude death rate continued to drop slightly from 5.3 per thousand in 1966 to 5.0 per thousand in 1971. From the age-specific death rates, it could be seen that the death rates for age groups 1-4 and 5-9 decreased by 60 to 80 per cent during 1961-1971. The reduction in the female death rates for quinquennial age groups between 10 and 44 years of age was mostly between 30 and 45 per cent, while the reduction in the male death rates for corresponding groups in this age range was generally not so marked in the last decade. For age groups beyond 45 years, the decline in death rates was less than 25 per cent for this ten year period. Infant mortality rate fell from 36.3 per thousand live births in 1961 to 18.4 per thousand in 1971.

The crude birth rate fell from 25.3 per thousand in 1966 to below 20 per thousand in 1971. The age-specific fertility rates for the quinquennial groups 15-19, 20-24, . . . , 45-49 were found to be 17.0, 145.6, 243.8, 162.5, 83.6, 28.4 and 3.6, respectively. Compared with the 1966 age-specific birth rates, it could be noted that a greater reduction in the birth rates was recorded in the less fertile age groups of less than 25 years or over 35 years of age. The reduction in the birth rates of younger age groups of 15-19 and 20-24 might partly be attributed to the fact that young women tended to get married a few years later in recent years than a decade or so ago.

It was estimated for the ten-year period from mid-1961 to mid-1971 that the total number of permanent immigrants entering Hong Kong legally was about 140,000 and the total number of permanent emigrants from Hong Kong was probably a few thousands higher. The total net negative balance of migration for the period was believed not to exceed 3,400. Figures on illegal migration were difficult to obtain. The number of illegal immigrants, based on the figures of their registering for identity cards, was estimated to fluctuate between 7,000 and 14,300 with an average of about 10,400 persons a year during the period 1963-1970.¹⁴

In making the projections, the 1971 Census data were firstly adjusted for error,

graduated and brought forward to mid-1971.

Table 11 Age and Sex Distribution of Hong Kong Population
(1971)

Age Group	Population Enumerated in the 1971 Census		Adjusted mid-1971 Population	
	Males	Females	Males	Females
0 — 4	193,166	183,025	209,300	196,700
5 — 9	259,283	248,830	262,700	252,000
10 — 14	267,671	255,929	271,800	259,600
15 — 19	219,657	208,187	227,300	215,100
20 — 24	173,211	163,142	177,400	164,400
25 — 29	107,121	86,603	116,500	95,400
30 — 34	117,066	95,559	115,200	94,400
35 — 39	129,490	115,631	133,100	118,300
40 — 44	133,659	121,890	134,900	123,800
45 — 49	112,946	106,424	116,200	108,400
50 — 54	100,968	94,295	101,300	94,600
55 — 59	74,933	75,671	76,700	78,900
60 — 64	52,292	63,409	54,700	64,300
65 — 69	28,393	45,267	28,400	47,200
70 — 74	17,441	35,611	18,400	36,100
75 — 79	7,738	20,464	7,600	21,500
80 — 84	3,815	11,282	3,900	11,400
85+	1,752	5,809	1,800	6,000
Total	2,000,602	1,936,028	2,057,200	1,988,100

Source: *Hong Kong Population and Housing Census 1971 Main Report, and Hong Kong Population Projections, 1971-1991, Census and Statistics Department, Hong Kong, 1973, p. 30.*

The future mortality rates were assumed to remain unchanged at the 1971 level for the low projection, and to continue to fall at a slower tempo with differential rates of decline among different age groups for high and medium projections. In estimating the declining age-specific death rates for the future years, annual mortality indices between 1961-1971 for each of the broad age groups 0, 1-4, 5-24, 25-39, 40-54 and 55 and over were computed and fitted to an exponential equation.¹⁵ Then the ratios of the mortality index for future years to the 1971 mortality index of the same age group were computed from the mortality trend equation of that group, and finally the estimated future age-specific death rates for males and for females were derived by applying the 1971 age-specific death rates to the ratios.

The fertility rates were also assumed to fall further at a slower rate and with differential speed for different child-bearing ages. A study of the fertility rates of individual child-bearing ages during the three years 1969 to 1971 revealed that the fertility rates were declining, except that some increases were noted for ages below 18 and for ages 26-28. Assumptions on future age-specific death rates and fertility rates are summarized in Table 12 and 13.

Table 12 Projected Age-Specific Death Rates
(1981 and 1991)

Age Groups	Age-Specific Death Rates, 1971		Projected Age-Specific Death Rates			
			1981		1991	
	Male	Female	Male	Female	Male	Female
0	21.0	15.5	18.7	13.8	16.4	12.1
1 - 4	1.0	0.8	0.9	0.7	0.7	0.5
5 - 9	0.4	0.3	0.4	0.3	0.4	0.3
10 - 14	0.4	0.3	0.4	0.3	0.4	0.3
15 - 19	0.6	0.4	0.6	0.4	0.6	0.4
20 - 24	0.9	0.6	0.9	0.6	0.8	0.6
25 - 29	1.5	0.7	1.4	0.7	1.3	0.7
30 - 34	1.9	1.0	1.8	0.9	1.7	0.9
35 - 39	2.6	1.5	2.4	1.4	2.3	1.3
40 - 44	4.1	2.2	4.0	2.2	3.8	2.1
45 - 49	6.1	3.3	5.9	3.2	5.6	3.0
50 - 54	10.4	5.5	10.1	5.3	9.6	5.0
55 - 59	17.8	7.9	17.6	7.8	17.2	7.6
60 - 64	29.1	11.8	28.7	11.6	28.0	11.4
65+	63.6	41.0	62.7	40.4	61.3	39.5

Source: *Hong Kong Population Projections, 1971-1991*; Census and Statistics Department, Hong Kong, 1973, pp. 13 and 26-27.

Table 13 Assumptions on Future Age-Specific Fertility Rates
(1981 and 1991)

Age Group	High Projection		Medium Projection		Low Projection	
	1981 (% change over 1971)	1991 (% change over 1981)	1981 (% change over 1971)	1991 (% change over 1981)	1981 (% change over 1971)	1991 (% change over 1981)
15 - 23	- 4%	0	-14%	- 5%	- 20%	- 5%
24 - 28	+ 3%	+ 2%	- 8%	- 3%	- 15%	- 10%
29 - 34	- 10%	- 5%	- 20%	- 10%	- 25%	- 15%
35 - 39	-15%	- 10%	- 25%	- 15%	- 40%	- 15%

Source: *Hong Kong Population Projections, 1971-1991, Census and Statistics Department, Hong Kong, 1973, p. 9.*

From the 1971 age-specific fertility rates for individual years and the assumed rates of change in fertility rates for various childbearing age groups, the projected age-specific fertility rates for individual years were computed for the high, medium, and low projections. The average sex-ratio at birth was found to be 1,064 boys to 1,000 girls from birth registration records for years 1968 to 1971, and this ratio was assumed to remain the same for the projection period 1971-1991.

On the balance of migration, an annual net gain of 18,000, 10,000 and 3,000 persons was assumed for high, medium and low projections, respectively. It was further assumed that the number of legal immigrants would balance the number of emigrants every year and that the age and sex distribution of the net gain by migration in future years would be similar to the following age and sex distribution of illegal immigrants who registered for identity cards from mid-1969 to mid-1971.

Table 14 Assumed AGE and Sex Distribution of Net Migration
(Percentages)

Age Group	Males	Females
	(Sex-ratio: 2,791 males to 1,000 females)	
Under 15	9.3	22.2
15 - 24	53.8	35.7
25 - 39	23.2	18.0
40 - 54	8.8	13.9
55+	4.9	10.3
Total	100.0	100.0

Source: *Hong Kong Population Projections, 1971-1991, Census and Statistics Department, Hong Kong, 1973, p. 28.*

Based on these assumptions, the low projection gave an eight per cent increase of the population between 1971-1976, and estimated the 1981 population at slightly below 4,750,000 persons. The medium projection figures were about 50,000 persons more than the low projection for 1976 and 120,000 persons more for 1981. The high projection averaged an increase of two and one-half per cent per year for 1971-1981 and put the estimated population total beyond five million for 1981.

Table 15 The Projected Population of Hong Kong
(1971-1991)

Year	High Projection	Medium Projection	Low Projection
1971	4,045,300	4,045,300	4,045,300
1976	4,471,100	4,417,800	4,370,600
1981	5,010,900	4,865,500	4,741,200
1986	5,657,300	5,377,400	5,142,700
1991	6,336,600	5,895,500	5,526,200

Source: *Hong Kong Population Projections, 1971-1991, Census and Statistics Department, Hong Kong, 1973.*

The Hong Kong Population was estimated to be just over 4.4 million by the 1976 By-Census. This figure was fairly close to the medium projection for 1976 in this set. But the mid-1981 population was 5,133,800, which was about 122,900 persons more than the high projection total for 1981 in the above table.

Although the high level projected population was close to the mid-1981 population, the actual pattern of population growth during the period 1971-1981 deviated greatly from the underlying assumptions made in 1971.

The high projection projected the proportion of those aged under 10 years to be 21 per cent of the total population but the estimated proportion in mid-1981 was only 16 per cent of the total population, or a difference of 205,800 persons. This was due to the decline in fertility. The factors which contributed to this decline in fertility were the tendency toward smaller families, availability of effective contraceptives, and the better education and job opportunities available for young women.

For each 10-year age group from 10-19 years onwards, the estimated mid-1981 population was higher than the projected population. It was more significant in the male distribution. These discrepancies were due to the under-estimated net migration in the period 1971-1981 which amounted to 50,000 persons¹⁶ per annum and these were mainly males.

Table 16 Age and Sex Distribution of Hong Kong Population
(Mid-1981, in thousands)

Age Group	1971-1991 Projection High Projection		Adjusted mid-1981 Population*	
	Males	Females	Males	Females
0 — 9	529.3	499.8	426.6	396.7
10 — 19	487.0	457.3	522.8	486.7
20 — 29	561.3	488.0	583.6	515.2
30 — 39	312.7	264.4	371.0	295.2
40 — 49	249.4	212.6	291.3	233.7
50 — 59	236.4	225.9	254.2	229.3
60 — 69	144.7	159.6	161.5	167.7
70+	61.6	120.9	70.9	127.4
Total	2,582.4	2,428.5	2,681.9	2,451.9

*Revised based on 1981 Census results on age and sex distribution.

Source: *Hong Kong Population Projections, 1971-1991, Census and Statistics Department, Hong Kong, p. 40.*

The Projections for 1976-1996

The 1976 By-Census, which consisted of a ten per cent sample survey of the land population on August 2, 1976 and a complete count of the marine population on May 31, 1976, gave an estimate of the total population at 4,402,990¹⁷. Approximately fifty-one per cent of the population were males and forty-nine per cent

females. Slightly below one-third of the population were below the age of 15, thirty per cent between the ages of 15 and 29, twenty per cent between the ages of 30 and 49, and the remaining eighteen per cent were aged 50 and above. Among those aged 15 and over, 57 per cent were married. The base year population for this 20-year projection 1976-1996 was obtained from the 1976 By-Census population figures by first adjusting for mid-reporting of age and then shifting them to mid-1976.

Table 17 Age and Sex Distribution of Hong Kong Population
(1976)

Age Group	Population Estimated in the 1976 By-Census		Adjusted Population on July 1, 1976	
	Males	Females	Males	Females
0 — 4	197,050	182,330	205,100	193,400
5 — 9	209,340	199,100	212,100	201,800
10 — 14	274,020	263,420	273,500	262,900
15 — 19	272,490	259,740	272,200	259,200
20 — 24	224,010	211,840	228,400	215,300
25 — 29	196,200	171,220	193,200	167,800
30 — 34	117,570	91,080	123,600	94,000
35 — 39	126,170	100,050	126,800	101,900
40 — 44	131,670	116,990	135,100	117,600
45 — 49	129,390	114,740	131,300	121,300
50 — 54	117,130	116,280	117,300	111,000
55 — 59	92,890	90,090	93,900	92,300
60 — 64	75,950	79,430	74,900	77,800
65 — 69	42,950	57,350	42,500	56,600
70 — 74	23,980	44,490	24,100	45,100
75+	20,250	53,780	19,600	52,200
Total	2,251,060	2,151,930	2,273,600	2,170,200

Source: *Hong Kong By-Census 1976 Main Report, and Hong Kong Population — A 20-Year Projection*, Census and Statistics Department, Hong Kong, 1978.

The major causes of death have changed considerably in the past years. In the early 1950's infectious and parasitic causes, respiratory system and digestive system diseases were the important causes of death, accounting for two-thirds of all the deaths at that time. But deaths from the above causes decreased continuously and in 1971 less than one-third of the deaths were due to these diseases. On the other hand, neoplasms, nervous and circulatory system diseases took more human lives away from Hong Kong in recent years. Deaths from these diseases rose from 12 per cent of all deaths in 1951 to 47 per cent in 1971.

In this projection, the standardized sex-cause-specific death rates were used. A log-linear equation was fitted to these standardized sex-cause-specific death rates in the past 16 years and projected to the next 20 years.¹⁸ The average sex-age-cause specific death rates for the five-year period 1972-76 were used as the base. Then an index of increase (or decrease) for the death rate of each cause group for each successive future year was obtained separately for males and for females by "comparing the projected standardized death rate of the particular cause group for the respective future year with that for the base period" and the index for each cause group was "disaggregated by age, based on assumed differentials in the mortality increase (or decrease) in the different broad age groups, and applied to the corresponding age-cause-specific death rates for the base period".¹⁹ This process was applied to all cause groups and these projected age-cause-specific death rates for a particular future year were added together to give the projected age-specific death rates for that year and for that sex. This set of projected sex-age-specific death rates is applied to the medium projection. A 5% downward adjustment to the set of projected rates derives the sex-age-specific death rates for the high projection, and a 5% upward adjustment gives the sex-age-specific death rates for the low projection. Table 18 shows the projected age-specific death rates for males for the years 1986 and 1996 used in the medium projection.

A study of the fertility rates of quinquennial child-bearing age groups during the period 1969 to 1976 revealed that the fertility rates declined by between 20 per cent to more than 50 per cent, except for the fact that the fertility rate for age group 15-19 remained stable at 17.4 per 1,000 female population. The net reproduction rate of Hong Kong came down steadily from 1.779 in 1969 to 1.185 in 1976.²⁰ It was also noted that the proportion of births of a fifth child and above to the total number of live births declined substantially from more than 20 per cent in 1969 to only 8 per cent in 1976. This reflected the tendency of young women's preference for a small family.

Table 18 Projected Age-Specific Death Rates (Male)
 (Medium Projection, Deaths per 1,000 male population)

Age Group	Year		
	1976	1986	1996
0	15.82	14.65	13.27
1 - 4	0.84	0.81	0.78
5 - 9	0.46	0.45	0.44
10 - 14	0.39	0.38	0.37
15 - 19	0.69	0.64	0.60
20 - 24	1.13	1.01	0.94
25 - 29	1.33	1.14	1.04
30 - 34	1.86	1.59	1.45
35 - 39	2.28	2.02	1.86
40 - 44	3.86	3.42	3.14
45 - 49	5.83	5.16	4.72
50 - 54	9.31	8.11	7.32
55 - 59	14.65	13.25	12.56
60 - 64	24.93	22.26	20.84
65 - 69	38.46	33.74	31.07
70 - 74	56.41	48.54	43.96
75+	94.64	83.89	79.13

Source: *Hong Kong Population - A 20-Year Projection*, Census and Statistics Department, Hong Kong, 1978, p. 57.

In this projection the projection of the birth rates by birth order for each child-bearing age was adopted. Then Hong Kong's net reproduction rate for each of the next 20 years was derived. These computed net reproduction rates were compared with those experienced by more developed countries. When significant deviations were found between the computed net reproduction rate for Hong Kong and those experienced by more developed countries, the assumptions on Hong Kong's future age-birth-order-specific birth rates would be altered in order to reach an acceptable net reproduction rate pattern. For example, the medium projection

assumes that the first order birth rate will remain constant at the 1976 level until 1983 and then start to increase slowly, the second order birth rate will remain constant at the 1976 level for the entire projection period, and the third and higher order birth rate will decline along the past trends until each approaches a low level. The net reproduction rate will, under these assumptions, "fall steadily to a level of 1 in 1981, and will continue to decline until it reaches 0.94 around 1987."²¹ Table 19 below shows the projected age-specific fertility rates for the years 1986 and 1996 used in the medium projection.

Table 19 Projected Age-Specific Fertility Rates
(Medium Projection, Births per 1,000 Female Population)

Age Group	Year		
	1976	1986	1996
15 - 19	17.4	17.9	20.3
20 - 24	109.7	106.1	116.5
25 - 29	192.1	161.9	170.1
30 - 34	119.6	77.8	76.5
35 - 39	48.9	27.0	25.5
40 - 44	14.6	7.0	6.3
45 - 49	1.5	0.6	0.6

Source: *Hong Kong Population - A 20-Year Projection*, Census and Statistics Department, Hong Kong, 1978, p. 49.

It has been very difficult to project the migration factor with reasonable confidence in the past. In this 20-year projection, four sub-components of this factor were studied separately. They were: emigrants, legal immigrants from China, legal immigrants from other countries, and illegal immigrants. Based on past experience, separate estimates for each of these sub-components were derived. The sum of the projected figures of these four sub-components gave the projected total net balance of migration as shown in Table 20.

Table 20 Projected Annual Net Balance of Migration

Component	High Projection	Medium Projection	Low Projection
Emigrants	-20,000	-30,000	-35,000
Legal immigrants from China	26,000	22,000	18,000
Legal immigrants from other countries	7,000	7,000	7,000
Illegal immigrants	15,000	13,000	10,000
Net balance of migration	28,000	12,000	0

Source: *Hong Kong Population - A 20-Year Projection*, Census and Statistics Department, Hong Kong, 1978, p. 63.

Based on the above projected assumption on mortality, fertility and migration trends of the Hong Kong population in the next 20 years, the Hong Kong population is expected to reach 4,997,700 by the low projection and the reach 5,365,200 by the high projection in 1986, and to be between 5,279,000 and 5,865,500 in 1991 and between 5,514,100 and 6,319,900 in 1996.

Table 21 The Projected Population of Hong Kong
(1976-1996)

Year	High Projectio	Medium Projection	Low Projection
1976	4,443,800	4,443,800	4,443,800
1981	4,873,200	4,794,300	4,720,200
1986	5,365,200	5,169,200	4,997,700
1991	5,865,500	5,543,300	5,279,000
1996	6,319,900	5,867,100	5,514,100

Source: *Hong Kong Population - A 20-Year Projection*, Census and Statistics Department, Hong Kong, 1978.

The projected population totals for 1981 were too low when compared with the mid-1981 population figure. Even the high projection total of 4,873,200 was 260,600 persons below the estimated mid-1981 population.

For those aged under 10 years, the high projection projected the proportion to be 17 per cent of the total population in mid-1981, the figure for the estimated population was 16 per cent, or a difference of 7,700 persons only. This was due to the continued decline in fertility rates though at a slower pace. The balance of the difference was mainly due to the large number of immigrants from China in 1976-1981 which was not envisaged and accounted for when this set of population projections was prepared in 1978. The inward migration also affected the sex structure of the population. The projected sex ratio was 1,060 in mid-1981 and the estimated sex ratio was 1,094.

Table 22 Age and Sex Distribution of Hong Kong Population
(Mid-1981, in thousands)

Age Group	1976-1996 Projection High Projection		Adjusted mid-1981 Population*	
	Males	Females	Males	Females
0 9	427.6	402.4	426.6	396.7
10 19	490.3	465.7	522.8	486.7
20 29	549.1	484.9	583.6	515.2
30 39	329.1	272.9	371.0	295.2
40 49	262.6	223.4	291.3	233.7
50 59	236.8	228.8	254.2	229.3
60 69	149.0	163.8	161.5	167.7
70+	62.6	124.2	70.9	127.4
Total	2,507.1	2,366.1	2,681.9	2,451.9

*Revised based on 1981 Census results on age and sex distribution.

Source: *Hong Kong Population - A 20-Year Projection, Census and Statistics Department, Hong Kong, 1978, p. 18.*

The Projections for 1981-2001

The 1981 Census, which was carried out in two separate phases, the marine census on February 2, 1981 and land census on March 9, 1981, recorded the total population of Hong Kong to be 4,986,560. This figure did not include 20,600 Vietnamese refugees pending resettlement overseas, 123,252 residents away from Hong Kong and 13,906 transients who had been in Hong Kong for less than 20 days and were not usually residents.²² The population showed an increase of 1,050,000 persons or 26.7 per cent in the 1971-1981 period.

Table 23 Age and Sex Distribution of Hong Kong Population
(1981)

Age Group	Population Enumerated in the 1981 Census		Adjusted Population on July 1, 1981	
	Males	Females	Males	Females
0 — 4	202,950	185,733	212,600	198,700
5 — 9	212,353	196,537	214,000	198,000
10 — 14	227,062	212,872	228,900	214,000
15 — 19	292,604	271,321	293,900	272,700
20 — 24	307,600	276,232	315,400	283,100
25 — 29	258,905	224,221	268,200	232,100
30 — 34	219,253	179,816	229,600	188,100
35 — 39	132,307	100,571	141,400	107,100
40 — 44	140,808	109,701	145,000	111,700
45 — 49	141,225	119,323	146,300	122,000
50 — 54	136,307	119,811	140,600	123,100
55 — 59	109,476	102,554	113,600	106,200
60 — 64	90,725	89,484	93,500	92,300
65 — 69	65,530	72,481	68,000	75,400
70 — 74	37,789	53,895	39,800	56,400
75+	29,274	67,840	31,100	71,000
Total	2,604,168	2,382,392	2,681,900	2,451,900

Source: *Hong Kong Population — A 20-Year Projection, Census and Statistics Department, Hong Kong, 1982, p. 14.*

The base population used for the present projections was derived from the 1981 Census. First the marine population collected from the marine census was adjusted to coincide with the land census reference data of March 9, 1981. The total population, sum of the enumerated land population and adjusted marine population, was adjusted for underenumeration and incorrect age entry. Then Greville's multipliers were applied to graduate the grouped population into single years and finally the graduated population was carried forward to mid-1981.²³

Between 1971 and 1981, the standardized death rate, which takes account of changes in age and sex structure of a population, decreased from 5 per 1,000 persons in 1971 to 3.7 in 1981.²⁴ It was noted that the mortality in infancy, childhood and the young adult ages fell considerably. From then onwards the pace was slow. The mortality improved more rapidly for males than for females. Some of the age-sex-specific mortality rates had reached the biological minimum.²⁵ A useful index in describing and comparing mortality conditions in a population is life expectancy. The expectation of life at birth also reflects the fall in mortality, the figure for males rose from 67.4 years in 1971 to 70.3 in 1981, the values for females were 75.0 and 76.8, respectively.²⁶ The age-sex-specific-mortality rates declined in all quinquennial age groups in the past decade. The leading causes of deaths have been diseases of the respiratory system and neoplasms, and diseases of the circulatory system. The infant mortality rate fell from 18.4 per thousand live births in 1971 to below 10 per thousand in 1981. The successful control of certain preventable diseases including gastroenteritis, pneumonia and tuberculosis, the provision of family health care and the improvements in socio-economic and environmental conditions contributed to the substantial decline in the infant mortality rate.

In projecting mortality rates, past trends in age-sex-specific death rates were assumed to continue for persons aged between 1 and 44. The projected infant mortality and mortality rates for those aged 45 and over were formulated by extrapolating trends in the age-sex-specific death rates using the reciprocal of linear regression curve. Special attention was given to those diseases such as neoplasms and diseases of the circulatory and respiratory systems which affected the total mortality. The projected age-specific death rates fell slightly for ages 0 to 4, remained unchanged for ages 5 to 34, and declined slightly for the remaining ages, especially the older ages. The projected future mortality was assumed not to fall below the 1978 mortality level of Sweden. The projected expectation of life at birth for males in 2001 will be 72.4 years and for females 78.2.

Table 24 Projected Age-Specific Death Rates

Age Group	1978-80		1991		2001	
	Males	Females	Males	Females	Males	Females
0	13.3	10.6	10.3	9.0	10.1	9.0
1 - 4	0.7	0.6	0.5	0.5	0.5	0.4
5 - 9	0.3	0.2	0.3	0.2	0.3	0.2
10 - 14	0.3	0.2	0.3	0.2	0.3	0.2
15 - 19	0.5	0.3	0.5	0.3	0.5	0.3
20 - 24	0.9	0.5	0.9	0.5	0.9	0.5
25 - 29	1.1	0.6	1.1	0.5	1.1	0.5
30 - 34	1.4	0.8	2.4	0.7	1.4	0.6
35 - 39	2.0	1.1	1.7	0.9	1.7	0.9
40 - 44	3.1	1.7	2.7	1.6	2.7	1.5
45 - 49	5.4	2.8	4.9	2.5	4.8	2.4
50 - 54	8.6	4.2	7.4	3.8	7.3	3.7
55 - 59	13.9	7.2	13.3	6.8	13.0	6.7
60 - 64	21.1	11.0	18.1	10.5	17.3	10.2
65 - 69	35.4	18.7	32.9	18.0	32.0	17.4
70 - 74	50.9	28.4	46.7	26.1	46.1	25.1
75+	92.8	69.3	88.7	66.1	88.5	65.7

Source: *Hong Kong Population - A 20-Year Projection, Census and Statistics Department, Hong Kong, 1982, p. 54.*

The crude birth rate fell from 19.7 per thousand in 1971 to 16.9 per thousand in 1981. It can be noted that greater reductions in agespecific-fertility rates appeared in older age groups 35-39, 40-44 and 45-49 in the 1970's. The net reproduction rate fell from 1.63 in 1971 to 0.93 in 1981. The most important factor in contributing to the decline in fertility in the last decade is the fast drop in the third- and higher-order births.²⁷ The mean number of children born to ever married women aged 15 to 49 was found to have decreased from 3.4 in 1971 to 2.5 in 1981.²⁸

During the last decade, the age-specific fertility rates declined for each age

group. The decrease in rates for those under 35 years was about 40 per cent between 1971 and 1981. For those aged 35 and over, the reduction in rates was more substantial, 58 per cent for those aged 33 to 39, 76 per cent for those aged 40 to 44 and 81 per cent for those aged 45 to 49.²⁹ The total fertility rate decreased from 3.41 in 1971 to 1.97 in 1981, and the figures for net reproduction rate were 1.63 in 1971 and 0.93 in 1981.³⁰ In 1981 the females produced 7 per cent less daughters to replace themselves. The factors affecting the decline in fertility are the rapid industrialization which raised the educational levels and labour force participation rates of females, pressures on housing which favored smaller families, desire for higher standard of living and the success of family planning.

The trends in the age-specific fertility rates by birth order between 1971 and 1981 were used in formulating the fertility assumptions. The fertility data were fitted to three different curves, the linear regression curve, the reciprocal of linear regression curve and the generalized exponential curve. In fitting the models, emphasis was placed on the trend in first and second order births at ages 20 to 34 and in third order births at ages 25 to 39.³¹ For ages 15 to 19 and 40 to 49 only the all-order age-specific fertility rates were projected, as contributions to fertility from these age groups were very small. Although the fertility rates of female Chinese immigrants were higher than those of local women during the period 1976-1980, only the composite fertility of local and migrant women was considered. However, the fitted coefficients have been adjusted to accommodate the effects of immigrants on fertility.

Based on the least squares method, the best fit was found to be the reciprocal of linear regression curve and was then brought forward into the future. The future age-specific fertility rates over the projected period would fall during this 20-year period 1981-2001 but at a slower pace than what had been experienced in the past ten years. The decline in fertility among women aged 20-29 would be the major factor in contributing to the total fertility decline in the first half of the projected period, while only minimal falls in fertility are assumed for the period 1991-2001.³²

Migration is the most difficult component to predict. It depends on the government's policy with regard to immigrants and the uncertainty over the future of Hong Kong may have a positive effect toward emigration. The future migration estimates were derived from considering the sizes of the following factors: emigrants, legal immigrants from China, legal immigrants from other countries and illegal immigrants. Hong Kong does not have data on emigration. One crude

Table 25 Projected Age-Specific Birth Rates
(Births per 1,000 female population)

Age Group	1979-1981	1991	2001
15 - 19	12	12	12
20 - 24	89	69	69
25 - 29	161	146	143
30 - 34	103	99	94
35 - 39	38	28	26
40 - 44	8	4	3
45 - 49	1	0	0

Source: *Hong Kong Population - A 20-Year Projection*, Census and Statistics Department, Hong Kong, 1982, p. 37, p. 42.

estimate is the difference between total departures and arrivals of Hong Kong residents. The average annual negative balance amounted to over 27,000 persons for the past decade. The number of legal immigrants from China fluctuated between 18,000 and 70,000 in the past few years. The number of legal immigrants from other countries was estimated to be around a gain of 7,000 persons a year. The number of illegal migrants entering Hong Kong was difficult to estimate. It could only be estimated from the number of identity cards applied for by illegal migrants sometime later. For the period mid-1971 to mid-1976 the number of illegal immigrants rose rapidly and the net gain due to migration was estimated to be 102,000. Between mid-1976 and mid-1981 there were 457,000 immigrants from China. Of those, 54 per cent were legal immigrants and the rest were illegal.³³ The flow of illegal immigrants was largely stopped after the 'reach-base' policy was abolished in October 1980. In other words, after October 1980 all illegal immigrants caught in Hong Kong are to be repatriated. For this 20-year projection, a net migration of 44,500 persons a year with similar sex-age distribution to that in the past was assumed.

Table 26 Population Size and Components of Change
(1970-1981, in thousands)

Year (Mid-mid)	Population at Start of Period	Component of change		
		Births	Deaths	Net-migration
1970-71	3,959.0	80.3	20.0	25.9
1971-72	4,045.3	79.5	21.0	11.9
1972-73	4,115.7	81.9	20.9	35.9
1973-74	4,212.6	82.5	22.6	49.1
1974-75	4,319.6	83.0	20.8	14.0
1975-76	4,395.8	77.7	22.6	-7.1
1976-77	4,443.8	80.2	23.2	8.9
1977-78	4,509.8	79.2	23.2	31.2
1978-79	4,597.0	82.2	24.2	164.4
1979-80	4,819.4	83.3	25.9	123.0
1980-81	4,999.8	85.5	24.1	72.6
1981-1982	5,133.8			

Source: *Demographic Trends in Hong Kong 1971-82 Census and Statistics Department, Hong Kong, p. 3.*

The projected total population of Hong Kong is likely to reach 6.24 million in 1991 and 7.71 million in 2001. During the first half of the projected period, 60 per cent of the population increase of over 1.1 million is due to natural growth. However, net migration plays an important role towards population growth in the second half of the projected period, about 50 per cent in 1996 and over 60 per cent in 2001. The annual population growth rate will fall from over 2 per cent in 1981 to 1.64 per cent in 1991 and to slightly over 1 per cent in 2001.

Table 27 Projected Total Population,
Components of Population Growth and Growth Rate

Period mid-mid	Total Population at end of Period	Total Births	Total Deaths	Net Immigration	Annual Population Growth Rate
1981*/1982	5,241,800	91,500	28,000	44,500	2.10
1985/1986	5,687,600	100,600	32,800	44,500	2.01
1991/1992	6,337,600	99,000	41,100	44,500	1.64
1995/1996	6,712,400	90,700	46,800	44,500	1.33
2000/2001	7,106,700	83,100	54,100	44,500	1.05

*The total population at mid-1981 is estimated to be 5,133,800.

Source: *Hong Kong Population - A 20-Year Projection, Census and Statistics Department, Hong Kong, 1982, p. 11.*

The aging of the Hong Kong population is projected to accelerate. For those aged 65 and over, the proportion will increase from 6.6 per cent in 1981 to 8.7 in 1991 and 10.1 in 2001. However, for those aged under 15, the proportion will decrease from 24.7 per cent in 1981 to 23.3 in 1991 and 20.6 in 2001. As a result, the working population proportion, 15-64, remains roughly the same over the projected period at 68 per cent.

Table 28 Results of the Projection
(1981, 1991, 2001, in thousands)

Age Group	1981	1986	1991	1996	2001
0 - 14	1,266	1,343	1,455	1,516	1,462
25 - 64	3,526	3,903	4,240	4,553	4,923
65+	342	442	540	643	722
Total	5,134	5,688	6,235	6,712	7,107

Source: *Hong Kong Population - A 20-Year Projection, Census and Statistics Department, Hong Kong, 1982, p. 11.*

Conclusion

The projections of the Hong Kong population have improved greatly in the past two decades. The two contributing factors are the cumulation of detailed demographic data for a longer period and the development of research techniques for population analysis. These two factors together have made possible more reliable assumptions on mortality, fertility and migration which form the basis for producing better population projections. In formulating mortality trends for Hong Kong, as major causes of death have changed considerably in the post-war period, the standardized sex-cause-specific death rates for broad age groups were first projected into the future and then summed over various causes to derive the projected age-sex-specific death rates. These projected death rates were then modified, if necessary, in the light of the experience of more advanced countries. In the recent set of projections, the reciprocal of linear regression curve was used to project the future death rates, replacing the exponential curve used in the earlier projections.³⁴ In formulating fertility trends, the fact that women in different child-bearing age groups would have different fertility patterns was recognised. In recent projections, the projection of the birth-order-specific fertility rates was adopted. The concept of net reproduction rate was then used to check the accuracy. Following the projection of age-specific fertility rates, the net reproduction rates were computed and compared with those of more developed countries. When significant deviations were found, the projected age-birth-order-specific fertility rates were modified to obtain a more acceptable value for the net reproduction rate. Migration remains the most difficult component to forecast in projecting the Hong Kong population. Though in recent projections, this factor has been broken down into the smaller components of emigrants, legal immigrants and illegal immigrants, in order to obtain better estimates of net migration. It is still the main source of error.

The accuracy of the first two sets of projections prepared in the 1960's can be criticized. For example, the 1961-based projections gave a range between 4,388,700 and 5,217,700 persons for the 1971 population. But even the lower limit of this range exceeded the estimated mid-1971 population total of 4,045,300 persons by 343,400 persons. Similarly, the projected 1976 population total from the 1971-based projections was between 4,503,200 and 4,926,100 persons, the lower limit of which was 60,000 persons over the estimated mid-1976 population total. In contrast, the 1976-based projections turned out to be too conservative. The

projected mid-1984 population size was between 4,884,100 and 5,163,800 persons. The estimated mid-1984 population was, in fact, 5,364,000, 200,000 persons over the upper limit of the projected range.

The most recent set of 1981-based projections for the period 1981 to 2001 were based on reasonably good assumptions. From the findings of this 20-year projection, the population size will grow from 5.13 million in 1981 to nearly 7.11 million in 2001. The sex ratio will be 1,074 males to 1,000 females. The annual growth is expected to be about 110,000 persons in the 1980's, 60 per cent of which will come from natural growth. The growth will slow down and the annual increase in the second half of the 1990's will be below 80,000 persons. During the 1990's migration growth will gradually become the more important factor. The rate of growth will slow down from 2.1 per cent per annum in the early 1980's to just over 1 per cent in 2001. The population is aging. The proportion aged 65 and over will increase from 7 per cent in 1981 to 10 per cent in 2001. However, the dependency ratio will decrease slightly from 456 per 1,000 population in 1981 to 444 in 2001.

FOOTNOTES

1. The details of these first three population projections are in the following publications: (1) Population projections for Hong Kong, 1961-1971, (2) Hong Kong Population Projections, 1966-1981, and (3) Hong Kong Population Projections, 1971-1991, all published by the Census and Statistics Department of the Hong Kong Government.
2. The details of the fourth population projection of Hong Kong are contained in "Hong Kong Population - A 20-Year Projection", published by the Census and Statistics Department, Hong Kong, 1978.
3. Hong Kong Population - A 20-Year Projection, Census and Statistics Department, Hong Kong, 1982.
4. Henry S. Shryock, J. S. Siegel and Associates, *The Methods and Materials of Demography*, U. S. Department of Commerce, 1975, p. 777.
5. Population Projections for Hong Kong, 1961-1971, Census and Statistics Department, Hong Kong, 1963. p. 2.
6. *Ibid.*, p. 4.
7. During this period, for example, the birth rate for the age group 25-29 rose from 287 per 1,000 to 297 per 1,000 and the rate for ages 30-34 decreased from 192 per 1,000 to 180 per 1,000.
8. The age-specific birth rates of the 6 quinquennial groups were weighted by a ratio of 1 of 1 : 6.5 : 7.2 : 2.4 : 5.2 : 4 : 0.5, derived from data supplied by Professor of Obstetrics and

Gynaecology, University of Hong Kong to obtain the general fertility rate.

9. See Appendix XXIV, Report on the 1961 Census, Hong Kong, Vol. II.
10. It was reported that the majority of those who emigrated from Hong Kong were among age groups of 15 to 29. This fact had been accounted for in the estimated distribution shown in Table 4.
11. The By-Census included a 5 per cent random sample of enumerator blocks at the first stage and a 20 per cent random sample of households at the second stage for the land population, and a 2.5 per cent sample of boats, stratified by size, for the boat population.
12. Answers to question of where the respondent was at the 1961 Census and at the beginning of 1966 provided useful information on the age and sex patterns of the new arrivals in the past five years.
13. This total included members of consular corps and armed forces but excluded transients who were in Hong Kong on the census day but intended to stay in Hong Kong for less than twenty days.
14. The number of illegal immigrants was estimated to be about 25,700 and 69,600 persons for 1961 and 1962, respectively.
15. The trend equations for the broad age groups 0, 1-4, 5-24, 25-39, 40-54 and 55 and over were found, in that order, to be:

$$Y = 1.731623X^{-0.352292}$$

$$Y = 2.696902X^{-0.689265}$$

$$Y = 1.563985X^{-0.283255}$$

$$Y = 1.325554X^{-0.174875}$$

$$Y = 1.243038X^{-0.133802}$$

$$Y = 1.106575X^{-0.059407}$$

16. Demographic Trends in Hong Kong 1971-82, Census and Statistics Department, Hong Kong, p. 3.
17. The total of the enumerated population was 4,330,110. This total was adjusted by (1) an upward adjustment of 150 due to the natural increase of the marine population which was counted two months before the land population, and (2) an upward adjustment to the land population for the non-contacted households.
18. These projected rates for later years were modified, if necessary, according to the experience of more-advanced countries.
19. See Hong Kong population — A 20-Year Projection, published by the Census and Statistics Department, Hong Kong, 1978.
20. Ibid., p. 47.
21. Ibid., p. 49.
22. Hong Kong 1981 Census Main Report, Vol. I, Census and Statistics Department, 1982 p. 15.
23. Hong Kong Population — A 20-Year Projection, Census and Statistics Department, Hong Kong, 1982, p. 59.

24. Demographic Trends in Hong Kong 1971-82, Census and Statistics Department, Hong Kong, 1983, p. 9.
25. Ibid., p. 9.
26. Hong Kong Population — A 20-Year Projection, Census and Statistics Department, Hong Kong, 1982, p. 47.
27. Hong Kong 1981 Census Main Report, Vol. I, Census and Statistics Department, 1982, p. 20.
28. Ibid., p. 127.
29. Ibid., p. 125.
30. Ibid., p. 20.
31. Hong Kong Population — A 20-Year Projection, Census and Statistics Department, Hong Kong, 1982, p. 34.
32. Ibid., p. 10.
33. Hong Kong 1981 Census Main Report, Vol. I, Census and Statistics Department, 1982, p. 187.
34. The initial slope of the reciprocal of linear regression curve is quite similar to that of the exponential curve, but it tends to tail less rapidly.

香港的人口預測評估

范叔欽 李兆麟

(中文摘要)

在現代國家中，政府對於未來人口的預測，都比較重視。因為從人口預測的成果中，可以得到很多對政府施政有用的資料，諸如教育設施、交通建設、公共工程、老幼的照顧等等，如有較佳的未來人口資料，定會產生更佳的效果，而避免浪費。

在過去二十多年中，香港政府在一九六一年、一九七一年和一九八一年人口普查後，和一九六六年和一九七六年人口抽樣調查後，都曾辦理人口預測，採用合成法，利用普查或抽樣調查所得資料作為基礎，再根據當時所有關於生育、死亡、和移民方面資料，來擬定生育、死亡、和移民這三項影響未來人口增長的假設，然後逐年推算五年後、十年後，甚至二十年後香港人口的總數和組成。

本文旨在討論香港人口預測過程中，如何利用所有資料來擬定生育、死亡和移民方面的假設，分析在預測過程中，各種技術方面的改進，並評估過去預測成果的精確程度。同時也從最近的人口預測，來探討到公元二〇〇一年時，香港人口的組成情況。

FUTURE RESEARCH DIRECTIONS ON FACTORS RELATED TO FERTILITY DECLINE IN TAIWAN, ROC*

*T. H. Sun***

I. INTRODUCTION

In a population which has little or no international migration, fertility and mortality are the two sole factors which directly determine the growth of the population. Of these two factors fertility is now the focus of the study due to the very low and stable level of mortality in many countries. The determinants of fertility, however, are very complex in its nature and have been studied from different points of view, including sociology, economics, psychology, anthropology, sociobiology, health, etc. All of these studies try to explain what decides the level of fertility, yet there is no sole study which could explain the mechanism of this complex phenomenon alone. The theories developed are meaningful in some sense but are not comprehensive enough to explain the whole picture in different situations. The Panel on Fertility Determinants, Committee on Population and Demography of the National Research Council in the United States has recently organized a conference on "Fertility Research and Population Policy in Developing Countries" to discuss what do we know, what does it mean, and what remains to be explored further¹. The results should provide us with a milage stone in this field considering the importance of the subject and the scholars invited to attend.

The have been many frameworks, schemes or models developed to explain the factors which determine fertility. A brief review of these thories would be useful in finding our future research directions. Ronald Freedman (1975) presented a model for the sociological analysis of fertility levels in 1961, which was revised slightly in 1975. He argues that social norms about family size and intermediate variables affect fertility through intermediate variables (Davis & Blake, 1956), which

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** Director, Taiwan Provincial Institute of Family Planning.

in turn are affected by social and economic structure (including family planning program). Mortality rates affect fertility through social and economic structures, norms and intermediate variables, while environment affect directly the social and economic structure and mortality. In another paper (Freedman, 1974), he laid out "what we need to know" and "what we know" about the variables listed in the model and concluded that the research has major shortcomings, yet provides sufficient knowledge for family planning programs to proceed without waiting for more scientific detail. He then gave six general principles to suggest where research can best assist family planning programs, i.e., each country require its own data and rates and their components; survey data on actual and potential family planning rates and their components; survey data on actual and potential family planning acceptors; family planning as a social experiment; research on the influence of economic factors on fertility; and research on biosocial process of reproduction. In his paper presented at the Conference on Population and Family Planning in Taipei, January 1983, he pointed out that Taiwan's fertility would not decline substantially to the replacement level without major changes in the norms about family size.

The economists suggest different models for explanation of the determinants of fertility. Harvey Leibenstein (1957) proposed a model of cost-utility analysis to explain how a couple decide whether to have the child or not. In his latest paper on the subject, he argues that a high proportion of the fertility rate is determined by "non-decision decisions", that is, passive or inertial decision-making (Leibenstein, 1981). He thinks that one of the important empirical research needs, at present, is to determine whether this is so, and to determine in which contexts passive decision-making is more important than in others. The approach developed by Becker and Willis emphasizes income, price, and child-quality changes as explanatory factors in fertility, on the assumption that tastes are given, once and for all (Willis, 1973). Price changes include changes in the costs of children and the opportunity costs of mother's time. Deborah Freedman (1963) has emphasized social status as a variable that may imply different categories of consumption expenditures. Richard Easterlin (1982) puts emphasis on endogenous taste changes. He argues that all of the determinants of fertility work through one or more of three categories, viz. the demand for children (desired family size), the supply of children (the number of surviving children when without attempt to limit family size), and the costs of fertility regulation (subjective disadvantages of regulation and the economic costs of control). A couple will be motivated to regulate their fertility

when supply exceeds demand but they would not do so unless the motivation is higher than the regulation costs. Any change in these three categories will affect fertility. He suggests that development policies may have effect on the demand of children; public health policies, the supply; and family planning programs, the cost of fertility regulation.

Socio-psychologists suggest cost and value of children scheme for explanation of fertility levels. It is hypothesized that the value of children will be influenced by socio-cultural and personal background and also availability of recognized alternatives/substitutions for children, but it in turn affect their desire for having children and hence future fertility through use of birth control measures (Fawcett and Arnold, 1973; Sun, 1982). Fertility is interpreted as the net result of the balance between satisfaction and cost of children taking into account the available alternatives/substitutions for children.

Bulatao and Lee in a report on *Determinants of Fertility in Developing Countries: An Overview and A Research Agenda*, (1982) developed a conceptual framework to organize knowledge about the complex interacting influences on fertility in the less developed countries. (Fig. 1) This framework is quite similar to that of Easterlin, i.e., it groups influences on fertility according to three channels through which they operate: demand, supply, and regulation costs, except that it has much broader scope for the three channels and a few other groups of influencing factors added. They found that the framework can accommodate all hypothetical influences on fertility, and therefore is useful in summarizing past knowledge and also in locating the areas which need further investigation. For convenience, this framework will be borrowed, with some modification, for discussion of what do we know and what we need to know about fertility determinants in Taiwan.

II. FERTILITY CHANGE AND RELATED FACTORS

From population policy point of view, the crude birth rate may mean more than fertility rates to many people because it affects directly the rate of natural increase which usually is the target of population growth. The crude birth rate of Taiwan has steadily fallen from a sustained high record of more than 40 per thousand prior to 1958 to 23.0 per thousand in 1975, a reduction of 50 per cent in about two decades. It rose, however, for the first time after the continuous decline to 25.9 in 1976 and then fell back to 23.0 in 1981, and 19.6 in 1984.

As Table 1 shows, the decline of crude birth rates in the past results from

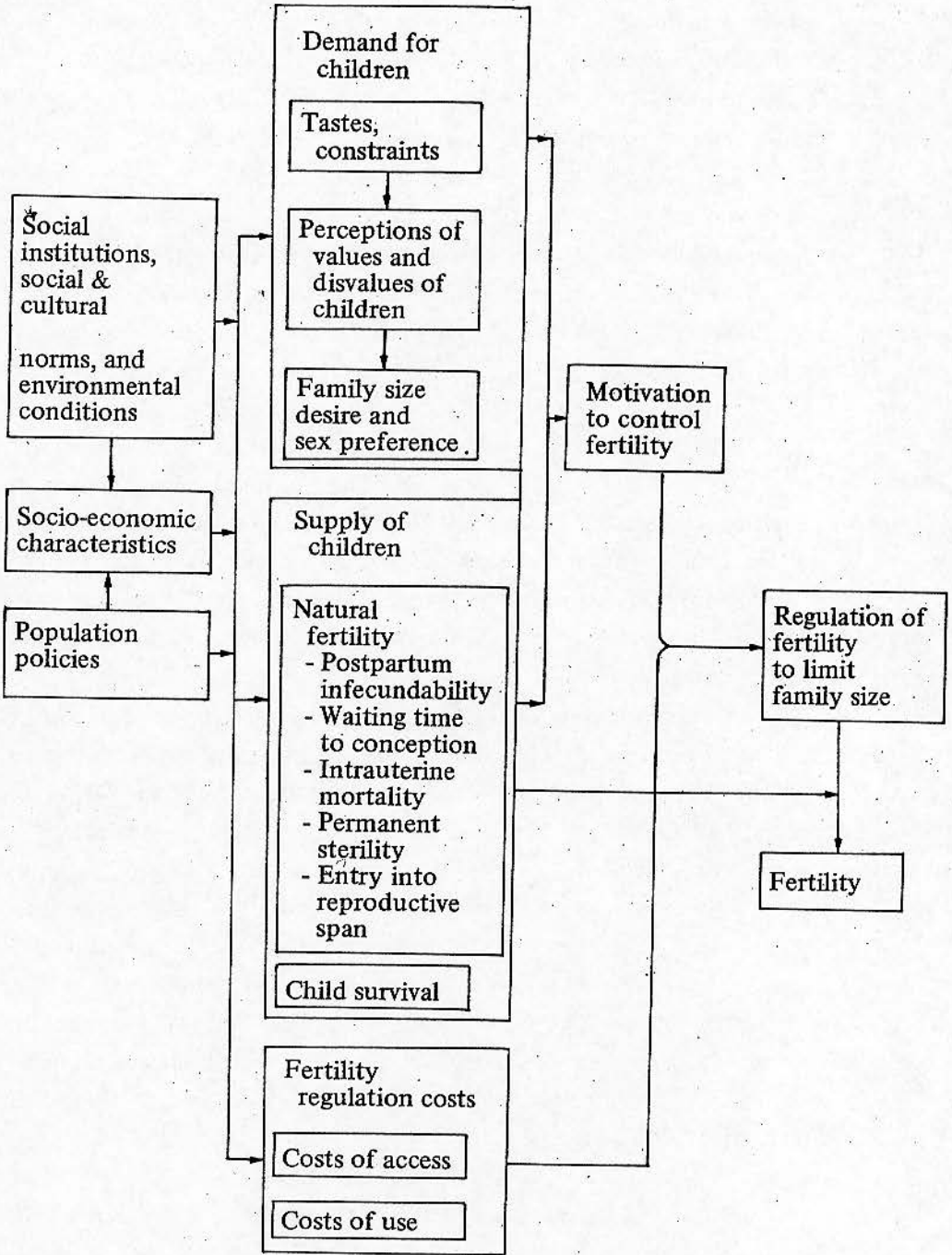


Fig. 1. A Conceptual Framework of the Interrelationships Among Basic Components of Fertility Determinants.

contribution in different degree of age composition, proportion married, and marital fertility during different periods. Before 1970, age structure was in favor of crude birth rate decline, but it changed to have positive effect, i.e., to increase the crude birth rate after 1970 due to the high birth rates in 1950's. The rise in crude birth rate between 1975 and 1979 was entirely contributed by changes in age structure. The age structure in Taiwan will continue to have positive effect until about 1988.

The contribution of the proportion married on crude birth rate has been negative for all of the four periods examined. The contribution was especially great during 1970-1975, reflecting a large reduction in the proportion married among women of ages 15-24. The age at first marriage for women in Taiwan increased from 20.8 in 1943 to 22.3 in 1975 and 23.8 in 1980. The proportion of women in the ages 15-19 who were currently married reduced from 9.2 percent in 1965 to 8.0 in 1970, 5.8 in 1975, and 5.0 in 1980. This proportion for women of ages 20-24 also decreased from 58.3 percent in 1965 to 50.3 in 1970, 43.2 in 1975, and 39.9 percent in 1980. This proportion for women of ages 25-29 did not change very much; only from 88.8 percent in 1965 to 78.9 percent. This trend, I am sure will continue as the society modernizes and industrializes together with the increase in education of women.

The changes in the marital fertility was the most important contribution to the decline of birth rates in the past. It expedited greatly the decline of crude birth rate before 1970, offset the adverse effect of age structure in the period 1970-1975, but was not large enough to compensate for the effect of age structure in the period 1975-1979. As Liu and Sun (1979) pointed out, the large proportion of fertility decline of women age 30 and above for the period 1960-1975 were entirely due to fertility control, and the proportion was especially large in 1970-1975 period. For age group 25-29, the effect of fertility control increased as time passed especially after 1970. The negative effect (-5.7%) of fertility control on fertility decline among women of ages 20-24 during 1965-1970 changed to positive (4.9%) in 1970-1975. These trends are also evident from the analysis of age-specific marital fertility trends (Liu and Sun, 1979).

From the analysis above, it seems to be clear that the fertility decline, measured in terms of crude birth rate, during the past two decades was mainly contributed by the couples' effort to regulate their fertility. The increase in age at marriage also contributed a significant amount; lowering the possible supply of children (see Fig. 1). The effect of age structure on crude birth rate decline, which is not shown in Fig. 1, changed from positive to negative, i.e., working against CBR

decline.

The motivation and the action on fertility regulation among Taiwanese couples are evident from the results of KAP surveys. The contraceptive practice rate increased from 24 percent in 1965 to 44 percent in 1970, 63 percent in 1976 and 70 percent in 1980. The important questions here, however, are: Why couples in Taiwan want to regulate their fertility? Through what mechanism were they motivated to do so? Which factors contributed to this process most? What are the prospects for the future change? There are no easy answers to these questions. An attempt is made here to try to explain this using the conceptual scheme shown in Fig. 1.

According to this scheme, motivation to control fertility is a net balance of the demand and supply of children (Easterlin, 1982). M. C. Chang (1982), after an examination of Easterlin framework using 1980 Taiwan KAP data, concluded that "the potential family size (supply of children) and the excess of potential over desired family size performed better than a number of alternatives. . . . in explaining use of birth control." It is quite reasonable to assume that a couple would not be motivated to control the fertility unless they have already had, or were assured to have the number of children they want to have, except for spacing of childbirths. Chang has already proved, using regression analysis, that this is quite true at the individual level. As Table 2 shows, this could also be recognized at the aggregate level. The proportion currently using contraceptives is significantly higher among women whose preferred number of children exceeds or equals to the number of living children. It should be noted, however, that the practice rate increased over time even among the group of women who have the same level of excess fertility (Number of living children $>$ number of children preferred) at different time. It should also be noted that the number of children preferred decreased about one child between 1965 and 1980 for all age groups, but the number of living children did not change very much for women under age 30. For women age 30 and above, the average number of living children decreased significantly (about one child) to match the preferred number of children; the average excess fertility did not exceed one child due to rather successful control of their fertility.

As Fig. 1 shows, the demand and the supply of children are not the only factors which determine the use of contraception. The cost of fertility regulation has to be lower than the motivation to control fertility (expressed in terms of the difference between the number living and the number preferred) before the action is taken to regulate fertility (Easterlin, 1982). The costs include economic, social

and psychological ones, viz. costs of access and cost of use. At the beginning of a family planning program, the costs tends to be higher because there will be fewer methods available at few service points, and the social and psychological costs are also high. As the program expands, however, the costs will be reduced with more contraceptive methods and service points available and lower social and psychological costs. The increase of practice rates over time among the women of about the same motivation situation in Table 2 supports this argument. As T. C. Hsu indicates (1983), Taiwan's family planning program has expanded greatly during the past 18 years reducing the regulation costs to a very low level. Therefore, it could be concluded that the high practice rate, which reduced the fertility level greatly in the past was achieved mainly by the reduction in the preferred family size and the costs of fertility regulation. However, how the demand of children and costs of fertility regulation were reduced remains to be answered.

Let us examine the groups of related factors following the scheme presented in Fig. 1. First of all, among the factors related to the supply of children in Taiwan, child survivors has increased greatly during the past years. The infant mortality has been reduced from 45 per thousand in 1952 to about 10 in 1980. Even after the correction of under registration, it is not likely to exceed 20 per thousand. This provides the parents with an assurance that children born will survive and therefore reduced the number of "spare children" they used to produce. However, the "perceived" child survivors seems to be lower than actual because of the exaggerated reporting by mass media or word of mouth communication on child mortality, especially accidents. This has an effect in leading couples to have excess fertility.

As for natural fertility, the entry into reproductive span has been postponed due to rise in the age at marriage, even though puberty seems to start earlier than before due to improvement in nutrition and health. There is no evidence of change in permanent sterility. The proportion of women ages 30-39 who have no live births stayed at 1.2 percent for both 1965 and 1980 KAP survey samples. The intrauterine mortality seems to have increased due to increased abortion, but the proportion of pregnancies ended in miscarriages or still births all maintained at about 6 percent for 1965 and 1980. The waiting time to conception may have been shortened because of the modernization effect, even though there have been little restrictions on postpartum sexual intercourse. The most important change here might be the reduction of postpartum infecundability due to decrease in the proportion of mothers who breastfed their babies. In 1965, 94 percent of mothers breastfed

their live birth before the last one but the proportion of mothers who breastfed the last live birth was only 62 percent in 1980. This factor is greatly affected by the changes in socioeconomic structure of society. The shortening of birth intervals in the recent decade is closely related to this change. Jain and Sun (1972) pointed out that the period of postpartum amenorrhea was about 11 months for those who breastfed their child but only about 4 months for those who did not.

The net result of these changes due to improvement in nutrition and health, increased incidence of induced abortion, decrease in breast-feeding, and rise in age at marriage might have increased the supply of children, but with the high proportion of use of contraceptives (80% of even use), it is not possible to show the real change in natural fertility. However, it could be said that, there are no problems for most of the Taiwanese couples to get the number of children they want to have, i.e., there will be little problem of the situation in which the demand is greater than supply.

The changes in the demand for children seems to have been the key to explanation of changes in fertility change because of its sensitive response to modernization. The preferred family size for wives of ages 22-39 reduced from 4 in 1965 to 2.8 in 1980. (see Table 2). The sex composition of preferred number of children changed from two sons and two daughters to 1.7 sons and 1.1 daughters during the same period. The question of why Taiwanese couples want these number of children is closely related to the value and cost of children which are affected by social structure, especially family structure, tastes and norms about children and so on. A study on the value of children in Taiwan (Sun, 1982) reveals that the most frequently mentioned important reasons for having children are: to continue family line, to complete the family, to avoid loneliness, to depend on in old age, and it is a part of being a woman (man). Among these reasons, continuation of family line and old-age support are negatively correlated with the level of education and the modernization progresses, implying that its value will be reduced further as modernization progresses. At this stage of development in Taiwan, children are still expected to contribute to family financially and to help around the house. In terms of financial costs, about 80 percent of Taiwanese couples could have two children without feeling financial burden, but 60 percent will feel a *heavy* financial burden if have four. It seems that the financial cost is one of the important factors in determining the number of children, i.e., a couple are very likely to increase the number of children until they feel a somewhat difficult financial burden. This expression, however, does not mean that there are no other costs, such as time

costs and opportunity costs.

The strong son preference is another important component of the demand for children in Taiwan. In 1965, 92 percent of the wives in ages 20-39 wanted to have at least two sons. This proportion was still at a high of 62 percent in 1980. The son preference expressed in terms of Coomb's IS scale looks even stronger: 88 percent of the wives belong to IS 5-7 in 1973. This proportion was still as high as 80 percent in 1980 even though there were some shift from IS 7 to IS 5. Strong son preference is regarded as one factor which affect couples to have more children than they originally intend to have.

The fertility regulation costs in Taiwan have been reduced to a very low level. Now, four contraceptive methods, viz., IUD's, pill, condom, and sterilization are made available through about 1,000 clinics which are distributed all over the Island almost proportionally to population distribution. In addition, pills, condoms, and other traditional methods are also available at local drug stores which are also very well spread all over the Island. For the convenience of the remote areas, there are several mobile teams organized by local Health Bureaus to provide special services. In other words, the costs of access is quite low. These methods are provided with low costs. The users pay only a small service fee of NT\$20 for a cycle of pill, NT\$15 for a dozen of condom, and NT\$30 for insertion of a loop or NT\$50 for insertion of a Copper T. The sterilization operation is provided free at the public hospitals and there is a subsidization of NT\$800 for tubal ligation and NT\$500 for vasectomy if accepted at a contracted private clinic. Therefore, economic cost of use is considered to be also small. The social cost is not high either because 97 percent of the couples approve the use of contraceptives and these contraceptive methods are also generally accepted by the older generation. There are, however, some psychological cost in terms of fear of side-effects of use of pills, IUD, and sterilization. This fear is more serious among couples with higher education and, as a result, it pushes these couples to shift to less effective but low side-effect methods, such as rhythm. This change has some effects on the effectiveness of contraceptive use. In general, however, the costs of fertility regulation are very low. This has greatly accelerated the use of contraceptive methods.

It should be pointed out that the family planning program has an additional function of education and motivation besides the provision of contraceptive methods. It has effect both on demand and supply of children. On the demand side, its emphasis on small family size, spacing, and equal importance of daughter and son has effect on the couples to reconsider their family size preference. Its

emphasis on education of the public on the population problems we face and the relationship between personal fertility behavior and social and economic development of nation should have the same effect. On the supply side, its emphasis on the importance of breastfeeding and on proper age to get married has effect on natural fertility. In addition, the program emphasis on promotion among lower status population and remote rural area has the effect of expediting the fertility regulation in these areas which are usually left behind. As Freedman et. al. pointed out, "The evidence from the area regression analysis is consistent with the idea that the program has an independent effect in the backward, high fertility areas where organized support would be most needed and substitute sources less available." (Freedman, *et. al.*, 1980). In general, "We believe that the program provided the primary motivation for wanting to limit family size, and it did have a significant role in helping those motivated to some degree to actually limit family size" (Freedman, *et. al.*, 1980).

Finally, we should not forget the important impacts the social and economic development had on the whole process. The change from the traditional to modern social and economic structure undoubtedly had a great impact not only on demand and supply of children but also on promotion of family planning. The recent development in population policy is believed to alter the climate in favor of reducing the demand for children further.

In summary, the socio-economic development and family planning promotion in Taiwan reduced the demand for children and the costs of fertility regulation. The reduction in child mortality and relatively high natural fertility made the supply of children to exceed the demand, thereby creating motivation to control fertility which combined with the low regulation costs expedited the regulation of fertility in Taiwan. The result was a significant decline in fertility which, however, is not low enough to meet the target of population growth required in the economic development plan. How to reduce it further is an important question.

III. FUTURE RESEARCH DIRECTIONS

In order to achieve the population growth rate of 1.25 per cent, the total fertility rate (TFR) has to be reduced to about 2.1 or the net reproduction rate (NRR) to 1, which eventually will lead to zero population growth (50 years later). The TFR in 1981 was still at 2.5 and the preferred family size is even larger, 2.8. It is obvious that before people are motivated to limit their family size to two, their

emphasis on education of the public on the population problems we face and the relationship between personal fertility behavior and social and economic development of nation should have the same effect. On the supply side, its emphasis on the importance of breastfeeding and on proper age to get married has effect on natural fertility. In addition, the program emphasis on promotion among lower status population and remote rural area has the effect of expediting the fertility regulation in these areas which are usually left behind. As Freedman et. al. pointed out, "The evidence from the area regression analysis is consistent with the idea that the program has an independent effect in the backward, high fertility areas where organized support would be most needed and substitute sources less available." (Freedman, *et. al.*, 1980). In general, "We believe that the program provided the primary motivation for wanting to limit family size, and it did have a significant role in helping those motivated to some degree to actually limit family size" (Freedman, *et. al.*, 1980).

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in the related areas for organized collective research activities. This coordination body should be responsible for making up overall research plans and also for resource allocation to avoid duplication or missing important topics of study.

Table 1. Decomposition of Changes in Crude Birth Rates,
Selected Time Periods, 1961-1979, Taiwan Area

Item	1961-1965	1965-1970	1970-1975	1975-1979
CBR, beginning of period	37.7	32.1	27.2	23.0
CBR, end of period	32.1	27.2	23.0	24.4
Changes in CBR due to:				
Age structure	-1.2	-0.2	+3.8	+2.7
Percent married	-0.8	-1.5	-2.5	-0.3
Marital fertility	-3.4	-3.2	-5.0	-1.7
Interaction	-2.0	0	-0.5	+0.7
All factors	-5.6	-4.9	-4.2	+1.4

Table 2. Comparison of Preferred Size and Number of Living Children, and Contraceptive Practice Rate by Age Groups for Recent Selected Years

Year	No. of children and practice rate	Wife's age				
		22-24	25-29	30-34	35-39	22-39
1965	(1) Preferred	3.7	3.8	4.0	4.3	4.0
	(2) Living	1.4	2.7	4.0	5.0	3.5
	(1) - (2)	2.3	1.1	0	-0.7	0.5
	Practice rate (%)	4	17	31	36	24
1967	(1) Preferred	3.6	3.6	3.9	4.2	3.8
	(2) Living	1.5	2.5	3.8	4.6	3.3
	(1) - (2)	2.1	1.1	0.1	-0.4	0.5
	Practice rate	7	23	41	50	34
1970	(1) Preferred	3.6	3.6	3.8	4.1	3.8
	(2) Living	1.7	2.6	3.8	4.6	3.4
	(1) - (2)	1.9	1.0	0	-0.5	0.4
	Practice rate	13	20	55	63	44
1973	(1) Preferred	3.0	3.0	3.3	3.6	3.2
	(2) Living	1.7	2.6	3.5	4.1	3.1
	(1) - (2)	1.3	0.4	-0.2	-0.5	0.1
	Practice rate	30	48	68	69	57
1976	(1) Preferred	2.7	2.7	3.0	3.2	2.9
	(2) Living	1.6	2.4	3.4	4.0	3.0
	(1) - (2)	1.1	0.3	-0.4	-0.8	-0.1
	Practice rate	28	55	76	79	63
1980	(1) Preferred	2.6	2.7	2.9	3.1	2.8
	(2) Living	1.5	2.3	3.0	3.6	2.7
	(1) - (2)	1.1	0.5	-0.1	-0.5	0.1
	Practice rate	41	64	78	84	70

Source: KAP and VOC Surveys of the Taiwan Provincial Institute of Family Planning.

NOTE

1. The conference was held on 22-23 November, 1982, in Washington, D. C., and 20 eminent scholars in this field were invited to present papers. The results are published in R. A. Bulatao and R. Lee (eds.), *Determinants of Fertility in Developing Countries* (two volumes), New York, Academic Press, 1983.

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有關台灣地區生育率降低因素 之研究方向

孫 得 雄

(中文摘要)

決定生育的因素非常複雜，其研究也是多方面的；包括社會學、經濟學、心理學、人類學、生物學、衛生等等。但，很難得到肯定而完善的單一解釋模式。Bulatao 及 Lee 根據 Easterlin 的理論所發展的一個「子女需要及控制生育」分析模式，可用以檢討有關台灣地區決定生育水準高低各因素的知識和將來研究方向。據此分析，台灣地區過去的社會經濟發展和家庭計畫推行工作，減少對子女的需要及控制生育的成本。幼年人口死亡率的下降及較高的自然生育力，使子女的供應超過需要量，因而創造控制生育的動機。此動機和控制成本的降低相配合，促進了生育力的控制與下降。將來，在子女需要上，須多了解為何台灣的民衆需要兩個以上子女，子女的價值如何，有何替代子女之事物，影響子女需要的因素及其作用，家庭結構的影響等。在供應方面，須多研究喂母乳的情形及影響因素，如何實施優生保健，及結婚年齡的變化與影響因素等。生育控制方面，應做生育控制的成本分析，研究不同型態地區的推行方式，人工流產的監視等。另外應研究人口政策對生育率的影響及人口教育的內容與方式等。建議籌設人口研究機構以便有計畫推動有關人口之研究工作。