Thai Journal of Development Administration Vol. 26, No. 4, October 1986

PROJECTION OF PRIMARY SCHOOL STUDENTS IN THAILAND FROM 1986 TO 2000

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1. Background

In the field of educational planning, numerous attempts have been made to project number of students at various level. The projected number form the basis for futher computations of manpower and financial resources needed to fulfill plan or programme targets. Basic to all of these efforts is the projection of the primary school students. Almost all projections of the compulsory primary school students in the past were based on enrollment ratio projections. The major problem of enrollment ratios is that the numerator covers a much wider age distribution of the primary school students due to early and late entry into the compulsory educational system of the eligible poppulation (under 6 and over 15 years of age) while its denominator is restricted to a much narrower range of age (6-8 or 6-11 years). This not only makes enrollment ratios a poor indicator of the achievement of the compulsory educational system but also a shaky basis for serious projections of the primary school students.

2. Objective

The main objectives of this paper are :

1. Making projections of the primary school students during the Sixth and Seventh Five-Year Plans 1987-1997.
2. Developing a general analytical model that can be used to project the number of the primary school students and students of other levels, if desired, which requires only minimum data available in Thailand and other less developed countries.
3. Developing an efficiency index that can be used to assess the overall performance of the educational systems at various levels.

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3. Conceptualization

Conceptually, the analytical model used here is based on following an annual cohort of primary school students from the year of first entry till the last year of their education. The size of cohort will be reduced as the students move from one grade to another. A cohort of students can be captured from the annual education statistics which show the number of repeaters, dropouts and promoters. Only the promotors are the members of the educational cohort from the previous year of a lower grade. Another way of capturing a cohort is to reduce the total number of primary students in a higher grade of the following year by the number of repeaters and dropouts. The matrix derived is a cohort retention matrix.

The conceptualization of the issue can be restated as follows :

Assume that in the year Y there are X_1 school entrants

Then in year Y+1 there will be X_2 left, $X_2 <= X_1$

In year Y+2, Y+3, Y+4, Y+5 there will be
X_3, X_4, X_5, X_6 left, $X_3 <= X_4 <= X_5 <= X_6$

From the statistics, a ratio of students in each grade in successive year (s) of the same cohort can be computed as follows :

Year 1, the ratio of students entered the system is the number of students and its own number, which is 1.

Year 2, the ratio of students who continue in a higher grade which is the ratio of the number students who are in the grade and the students in the previous year of the lower grade.

The whole set of ratios will form a retention matrix as follows :

Year	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
1	$R_0 = X_1 / X_1$					
2		$R_1 = X_2 / X_1$				
3			$R_2 = X_3 / X_2$			
4				$R_3 = X_4 / X_3$		
5					$R_4 = X_5 / X_4$	
6						$R_5 = X_6 / X_5$

From the retention matrix, one can compute the proportion of each cohort who stay in and complete the final grade of the system. This can be conceptualized as follows :

Year 1 the number of students will be $R_0 \times X = X$,

since $R_0 = 1$

Year 2 the number of students will be $R_1 \times R_0 \times X$

Year 3 the number of students will be $R_2 \times R_1 \times R_0 \times X$

Year 4 the number of students will be $R_3 \times R_2 \times R_1 \times R_0 \times X$

Year 5 the number of students will be $R_4 \times R_3 \times R_2 \times R_1 \times R_0 \times X$

Year 6 the number of students will be $R_5 \times R_4 \times R_3 \times R_2 \times R_1 \times R_0 \times X$

For 6 years of education the number of students in the system is the summation of number students in year 1 to year 6 as follows :

$$R_0 \times X + R_1 \times R_0 \times X + R_2 \times R_1 \times R_0 \times X + R_3 \times R_2 \times R_1 \times R_0 \times X + R_4 \times R_3 \times R_2 \times R_1 \times R_0 \times X + R_5 \times R_4 \times R_3 \times R_2 \times R_1 \times R_0 \times X$$

or

$$R_0 \times X (1 + R_1 + R_2 \times R_1 + R_3 \times R_2 \times R_1 + R_4 \times R_3 \times R_2 \times R_1 + R_5 \times R_4 \times R_3 \times R_2 \times R_1)$$

Let $A_k = (i + R_1 + R_2 \times R_1 + R_3 \times R_2 \times R_1 + R_4 \times R_3 \times R_2 \times R_1 + R_5 \times R_4 \times R_3 \times R_2 \times R_1)$

Then $A_k = 1 + \prod_{i=2}^{b} \prod_{j=2}^{i} [R_{(k+j-i),j}]$

; k = The cohort year
j = Graode 2....6

The significance of A_k is that it can be used an index for assessing the efficiency of the educational system. If the system sucessfully retains all students who enter the system from the first to the final year, in our case from grade 1 to grade 6, then each student will stay in the system from the first to the final year. In our case, each will have 6 years of life in the system. Any deviation from this indicates the inefficiency of the system in providing necessary education to the target population.

Given the proportions of students and eligible population over time by cohort, one can use them to project the trend and use the projected values to estimate the number of students at each level of education by year. The magnitude of the proportion of students over eligible population is determined by the capacity of the system to absorb and retain the students at each successive level over calendar years. This way of conceptualization links the relationship between A_k and the proportions of the students over eligible population, which can be used in constructing an estimation or forecasting equation.

4. Data Requirements

1. Number of Primary school students by grade and by year.
2. Number of eligible population, children between 6 and 11 years of age. However the age range can be anything from 6 to 8 or 6 to 15. The choice is a matter of preference, The point will be clearly illustrated in the analytical model.

5. Source of Data

Data used in this paper come from 3 major sources :

1. Working Group on Population Projections for The Sixth Five-Year Plan, National Economic and Social Department Board.
2. National Primary Education Commission.
3. Division of Public Relations, Office of The General Education Commision.

The first source provides data on population by age group during 1980 and 2000. The second source provides data on primary school students by grade by year since 1981. Data on primary school students before 1981 come from the third source of information.

Data on the primary school students were evaluated and found to be 85% complete. The factors used to adjust the data as follows :

1) A multiplier of 1.198847 is used to adjust data on the first year primary school students.
2) A multiplier of 1.179932 is used to adjust the total number of primary students.

Population data by age group and 5-year interval are redistributed into single age and single calendar year.

The formula used to redistribute the projected population in each age group a five year interval to single calendar year is

$$Pt = Po \times e^{rt}$$

Where Pt is the population in the required year t.
r is the rate of increase of population during the two projected five year interval.
t is the number of year from original year o.

Table 1 Projected Total Number of Population (5–14 yrs.) During 1977–2000 (Low Projection)

(× 1000)

Year	Age											
	5	6	7	8	9	10	11	12	13	14	6–8	6–11
1977	1245	1239	1232	1223	1212	1201	1189	1169	1134	1090	3693	7296
1978	1246	1241	1237	1231	1224	1216	1209	1191	1158	1115	3710	7359
1979	1246	1244	1242	1240	1236	1232	1229	1214	1183	1142	3726	7422
1980	1247	1247	1248	1248	1248	1248	1249	1238	1209	1169	3742	7487
1981	1248	1247	1247	1248	1247	1247	1247	1238	1215	1182	3743	7483
1982	1250	1248	1247	1247	1246	1245	1245	1238	1221	1196	3743	7479
1983	1252	1249	1247	1246	1245	1244	1243	1238	1227	1211	3743	7475
1984	1254	1250	1247	1246	1244	1243	1241	1238	1233	1225	3743	7471
1985	1256	1251	1247	1245	1243	1242	1239	1238	1239	1240	3743	7467
1986	1259	1256	1253	1250	1248	1245	1240	1237	1238	1239	3758	7491
1987	1262	1260	1258	1255	1252	1248	1241	1237	1237	1239	3774	7515
1988	1265	1265	1264	1261	1257	1251	1242	1237	1236	1238	3790	7539
1989	1268	1270	1269	1266	1261	1254	1243	1236	1235	1237	3805	7563
1990	1271	1275	1275	1271	1265	1257	1245	1236	1234	1236	3821	7587
1991	1249	1257	1261	1262	1260	1256	1249	1244	1241	1241	3779	7544
1992	1228	1239	1247	1252	1255	1255	1254	1251	1249	1246	3738	7502
1993	1207	1221	1233	1243	1250	1255	1258	1259	1256	1251	3697	7460
1994	1186	1204	1220	1233	1245	1254	1263	1266	1263	1256	3657	7418
1995	1165	1187	1206	1224	1240	1254	1267	1274	1271	1261	3617	7377
1996	1142	1161	1181	1199	1216	1233	1250	1260	1261	1256	3541	7240
1997	1119	1137	1156	1175	1194	1213	1232	1246	1251	1251	3467	7105
1998	1096	1112	1131	1151	1171	1193	1215	1232	1242	1246	3394	6973
1999	1074	1089	1107	1127	1150	1173	1198	1218	1232	1241	3323	6843
2000	1052	1065	1083	1104	1128	1154	1181	1205	1223	1236	3253	6716

Table 2 Projected Total Number of Population (5–14 yrs.) During 1977–2000 (Medium Projection)

(× 1000)

Year	Age											
	5	6	7	8	9	10	11	12	13	14	6–8	6–11
1977	1245	1239	1232	1223	1212	1201	1189	1169	1134	1090	3694	7296
1978	1246	1241	1237	1231	1224	1216	1209	1191	1158	1115	3709	7358
1979	1246	1244	1242	1240	1236	1232	1229	1214	1183	1142	3726	7423
1980	1247	1247	1248	1248	1248	1248	1249	1238	1209	1169	3743	7488
1981	1248	1247	1247	1248	1247	1247	1247	1238	1215	1182	3742	7483
1982	1250	1248	1247	1247	1246	1245	1245	1238	1221	1196	3742	7478
1983	1252	1249	1247	1246	1245	1244	1243	1238	1227	1211	3742	7474
1984	1254	1250	1247	1246	1244	1243	1241	1238	1233	1225	3743	7471
1985	1256	1251	1247	1245	1243	1242	1239	1238	1239	1240	3743	7467
1986	1260	1256	1252	1250	1247	1244	1240	1237	1238	1239	3758	7489
1987	1264	1261	1258	1254	1251	1247	1241	1237	1237	1239	3773	7512
1988	1268	1266	1263	1259	1255	1249	1242	1237	1237	1238	3788	7534
1989	1272	1271	1268	1264	1259	1252	1243	1237	1236	1237	3803	7557
1990	1276	1276	1274	1269	1263	1255	1244	1237	1235	1236	3819	7581
1991	1263	1266	1266	1264	1261	1256	1249	1244	1241	1240	3796	7562
1992	1250	1255	1258	1260	1259	1257	1254	1251	1248	1245	3773	7543
1993	1238	1245	1251	1255	1258	1259	1259	1257	1254	1249	3751	7527
1994	1225	1235	1244	1251	1256	1260	1264	1264	1260	1253	3730	7510
1995	1213	1225	1236	1246	1254	1262	1269	1271	1267	1258	3707	7492
1996	1197	1209	1220	1231	1241	1250	1259	1263	1262	1256	3660	7410
1997	1182	1193	1205	1216	1227	1238	1249	1256	1257	1255	3614	7328
1998	1167	1178	1189	1201	1213	1226	1239	1248	1253	1253	3568	7246
1999	1153	1162	1174	1187	1200	1214	1229	1241	1248	1252	3523	7166
2000	1138	1147	1159	1172	1187	1203	1219	1233	1243	1250	3478	7087

Once the population in each age group by single calendar year is obtained, it is then redistributed by single age, using Sprague multipliers.

The results of redistribution of the population of the low level projection are shown in Table 1 and the medium level projection in Table 2.

6. Computational Procedures.

Given the above conceptuallization, the procedure of computation is as follows :

1. The retention-transition matrix shown in table 4 is obtained by computing various values of $R_{i,j}$ based on the statistics compiled by the National primary Education Commision (Table 3)

The matrix fulfills the following condition :

$$R_{i,j} = \frac{(X_{i,j}) \times 100}{X_{(i-1),(j-1)}} \quad \text{When } X_{(i-1),(j-1)} > 0$$

$$= 1 \quad \text{When } 1 = i$$

$X_{i,j}$ = The number of the students in i^{th} grade in j^{th} year.

$R_{i,j}$ = The retention proportion in i^{th} grade in j^{th} year.

Table 3 Number of Primary school students by Class by year (1977 - 1984)

Year	G1	G2	G3	G4	G5	G6	Total
1977	1308762	1129039	1100137	959124	563516	412191	5472769
1978	1381243	1141489	1118705	1003900	812296	452881	5910514
1979	1247921	1212240	1116955	1014865	901722	679606	6173309
1980	1200605	1110671	1150125	1031360	941477	738600	6172838
1981	1179362	1095857	1085448	1135231	1013373	834461	6343732
1982	1122114	1048508	1037986	1044024	1036932	890442	6180006
1983	1081733	1080042	1010909	1009586	1027434	1023767	6233471
1984	1130538	1024612	1016534	1003566	1003672	947516	6126438

Source :

Division of Public Relations, "Statistics of Primary Education in THAILAND, during 1977-1981", Office the General Education Commission.
National Primary Education Commission.

Notes : Data are about 85 % complete.

Table 4 Transition matrix of Primary School students (1977-1984)

Year	G1	G2	G3	G4	G5	G6
1977	100.000	-	-	-	-	-
1978	100.000	87.219	-	-	-	-
1979	100.000	87.764	74.427	-	-	-
1980	100.000	89.002	73.078	67.247	-	-
1981	100.000	91.275	77.415	68.436	61.018	-
1982	100.000	88.905	78.912	72.769	61.701	52.681
1983	100.000	96.251	76.207	72.700	68.880	55.643
1984	100.000	94.719	87.195	72.940	70.297	62.513

Notes : The matrix is derived fromTable 3

2. The estimate of rate of change in retention by grade is as follows :

$$\Delta R_i = \frac{\sum_{j}^{C} (R_{i,(j+1)} - R_{i,j})}{n_j - 1}$$

i Start from grade 2,3,.....,6
j is the year.
n_j is the number of year during the interval of estimates.

3. From the estimated rate of change of R_j $(j = 1....6)$ a projected of future retention rates is projected to the required year (s), The result is shown in Table 5.

Table 5 Projected Transition Matrix of Primary School Students (1985–2000)

Year	G1	G2	G3	G4	G5	G6
1985	100.000	95.969	86.803	78.512	72.212	64.986
1986	100.000	97.219	88.957	80.864	74.643	67.504
1987	100.000	98.469	91.138	83.250	77.114	70.069
1988	100.000	99.719	93.345	85.668	79.624	72.679
1989	100.000	100.000	95.579	88.120	82.174	75.335
1990	100.000	100.000	96.899	90.604	84.764	78.036
1991	100.000	100.000	97.951	93.122	87.394	80.783
1992	100.000	100.000	99.002	95.672	90.063	83.577
1993	100.000	100.000	100.000	98.256	92.773	86.416
1994	100.000	100.000	100.000	100.000	95.522	89.300
1995	100.000	100.000	100.000	100.000	97.512	92.231
1996	100.000	100.000	100.000	100.000	98.777	95.207
1997	100.000	100.000	100.000	100.000	100.000	98.229
1998	100.000	100.000	100.000	100.000	100.000	100.000
1999	100.000	100.000	100.000	100.000	100.000	100.000
2000	100.000	100.000	100.000	100.000	100.000	100.000

Notes :

a) this Matrix assumes 100 % to be the limit of retention rate(s). The annual increase is based on the average of successive annual rate of increase.

b) Since not all eligible population entered Pratom 1 one needs to estimate the annual population of eligible population entered Pratom 1.

4. Projection of $R_{i,j}$ for the required year $R_{i,j} <= 100.00$.

5. Given $R_{i,j}$, a vector of A_k is computed based on the following equation :

$$A_k = 1 + \prod_{i=2}^{b} \prod_{j=2}^{i} [R_{(k+j-1),j}]$$

k = the cohort year (first cohort 1977)
i = grade 2,3,...,6

The results of computation are shown in Table 6.

Table 6 Projected A_k of Each Year Cohort.

Year	A	Year	A	Year	A
1977	3.966	1985	5.110	1993	6.000
1978	3.994	1986	5.262	1994	6.000
1979	4.250	1987	5.421	1995	6.000
1980	4.356	1988	5.581	1996	6.000
1981	4.300	1989	5.701	1997	6.000
1982	4.787	1990	5.825	1998	6.000
1983	4.821	1991	5.913	1999	6.000
1984	4.963	1992	5.976	2000	6.000

6. Estimation of the proportion of students entering the edcucational system over eligible population can be obtained in a number of ways. Three alternatives adopted are :

6.1 Proportion of students in first grade over population aged 6-8 years, i.e. $G_1 / P_{(6-8)}$

6.2 Proportion of all primary school students of all grades over population aged 6-8 years, i.e. $G_{(1-6)} / P_{(6-8)}$

6.3 Proportion of all primary school students of all grades over popuation aged 6-11 years, i.e. $G_{(1-6)} / P_{(6-11)}$

Eventhough the proportions are computed from actual data but they considered to be estimates since the available data are about 85% complete and the exact degree of completeness is unknown. These proportions will be futher adjusted by estimated weights.

7. Estimation of weights for adjusting the proportions obtained in step 6 is done by linking the proportion of each year with the value of A_k of the same year, using the following regression equation :

$$W_j = a + b \text{ Ln } (A_j)$$

W_j is the proportion estimated in step 6.

The result are shown in Table 7

Table 7 Regression Analysis of Student-Children Ratios By Sum of Entering and Promoting Ratios.

Stat. Item	ER1	ER2	ER3
Intercept. (a)	0.5336549	1.065801	0.569566
Regression coef.	-0.1462603	0.391793	0.175583
(a) Std. error	0.0827603	0.148940	0.070645
Regress. Std. error	0.0568821	0.103222	0.048960
Std. error Est.	0.0212558	0.038572	0.018296
Coeff. of Deter.	0.5242452	0.705982	0.681899
Correl ation Coeff	- 0.7240478	0.840228	0.825772

Notes :

$$ER1 = \frac{G1}{P(6-8)}$$

$$ER2 = \frac{G(1-6)}{P(6-8)}$$

$$ER3 = \frac{G(1-6)}{P(6-11)}$$

8. Adjustment of the retention transition matrix to estimate the number of students entering the first grade is done as follows :

In case of using $G_1 / P_{(6-8)}$. $G_1 = W_j \times P_{(6-8)}$ ER1

In case of using $G_{(6-8)} / P_{(6-8)}$. $G_1 = \frac{W_j \times P_{(6-8)}}{A_j}$ ER2

In case of using $G_{(6-8)} / P_{(6-11)}$ $G_1 = \frac{W_j \times P_{(6-11)}}{A_j}$ ER3

For the last two cases, the estimate of students entering the first grade must be adjusted by A_k , shown in the formula ER2 and ER3.

The results of adjustment are shown in Tables 8, 9 and 10 for ER1, ER2 and ER3 respectively.

Table 8 Adjusted Transition Matrix for Projection of Primary School Students during 1985-2000, using ER1.

Year	G1	G2	G3	G4	G5	G6
1985	0.306	0.960	0.868	0.785	0.722	0.650
1986	0.300	0.972	0.890	0.809	0.746	0.675
1987	0.293	0.985	0.911	0.833	0.771	0.701
1988	0.287	0.997	0.933	0.857	0.796	0.727
1989	0.283	1.000	0.956	0.881	0.822	0.753
1990	0.278	1.000	0.969	0.906	0.848	0.780
1991	0.274	1.000	0.980	0.931	0.874	0.808
1992	0.273	1.000	0.990	0.957	0.901	0.836
1993	0.272	1.000	1.000	0.983	0.928	0.864
1994	0.272	1.000	1.000	1.000	0.955	0.893
1995	0.272	1.000	1.000	1.000	0.975	0.922
1996	0.272	1.000	1.000	1.000	0.988	0.952
1997	0.272	1.000	1.000	1.000	1.000	0.982
1998	0.272	1.000	1.000	1.000	1.000	1.000
1999	0.272	1.000	1.000	1.000	1.000	0.982
2000	0.272	1.000	1.000	1.000	1.000	1.000

Notes : This Matrix covered appx. 85 % of Total Students.

Table 9 Adjusted Transition Matrix for Projection of Primary School Students during 1985-2000, using ER2.

Year	G1	G2	G3	G4	G5	G6
1985	1.674	0.960	0.868	0.785	0.722	0.650
1986	1.693	0.972	0.890	0.809	0.746	0.675
1987	1.712	0.985	0.911	0.833	0.771	0.701
1988	1.726	0.997	0.933	0.857	0.796	0.727
1989	1.738	1.000	0.956	0.881	0.822	0.753
1990	1.751	1.000	0.969	0.906	0.848	0.780
1991	1.761	1.000	0.980	0.931	0.874	0.808
1992	1.765	1.000	0.990	0.957	0.901	0.836
1993	1.768	1.000	1.000	0.983	0.928	0.864
1994	1.768	1.000	1.000	1.000	0.955	0.893
1995	1.768	1.000	1.000	1.000	0.975	0.922
1996	1.768	1.000	1.000	1.000	0.988	0.952
1997	1.768	1.000	1.000	1.000	1.000	0.982
1998	1.768	1.000	1.000	1.000	1.000	1.000
1999	1.768	1.000	1.000	1.000	1.000	1.000
2000	1.768	1.000	1.000	1.000	1.000	1.000

Notes : This Matrix covered appx. 85 % of Total Students.

Table 10 Adjusted Transition Matrix for Projection of Primary School Students during 1985–2000, using ER3.

Year	G1	G2	G3	G4	G5	G6
1985	0.838	0.960	0.868	0.785	0.722	0.650
1986	0.846	0.972	0.890	0.809	0.746	0.675
1987	0.854	0.985	0.911	0.833	0.771	0.701
1988	0.861	0.997	0.933	0.857	0.796	0.727
1989	0.866	1.000	0.956	0.881	0.822	0.753
1990	0.872	1.000	0.969	0.906	0.848	0.780
1991	0.877	1.000	0.980	0.931	0.874	0.808
1992	0.878	1.000	0.990	0.957	0.901	0.836
1993	0.880	1.000	1.000	0.983	0.928	0.864
1994	0.880	1.000	1.000	1.000	0.955	0.893
1995	0.880	1.000	1.000	1.000	0.975	0.922
1996	0.880	1.000	1.000	1.000	0.988	0.952
1997	0.880	1.000	1.000	1.000	1.000	0.982
1998	0.880	1.000	1.000	1.000	1.000	1.000
1999	0.880	1.000	1.000	1.000	1.000	1.000
2000	0.880	1.000	1.000	1.000	1.000	1.000

Notes : This Matrix covered appx. 85 % of Total Students.

9. Multiplying the adjusted transition matrix (Table 8) by the factor of 1.198847, and transition matrices (Tables 9 and 10) by a factor 1.179932 to obtain the final adjusted transition matrices shown in Tables 11, 12 and 13 respectively.

Table 11 Adjusted Transition Matrix for Projection of Primary School Students during 1985–2000, using ER1.

Year	G1	G2	G3	G4	G5	G6
1985	0.367	0.960	0.868	0.785	0.722	0.650
1986	0.359	0.972	0.890	0.809	0.746	0.675
1987	0.350	0.985	0.911	0.833	0.771	0.701
1988	0.344	0 997	0.933	0.857	0.796	0.727
1989	0.338	1.000	0.956	0.881	0.822	0.753
1990	0.333	1.000	0.969	0.906	0.848	0.780
1991	0.328	1.000	0.980	0.931	0.874	0.808
1992	0.326	1.000	0.990	0.957	0.901	0.836
1993	0.325	1.000	1.000	0.983	0.928	0.864
1994	0.325	1.000	1.000	1.000	0.955	0.893
1992	0.325	1.000	1.000	1.000	0.975	0.922
1996	0.325	1.000	1.000	1.000	0.988	0.952
1997	0.325	1.000	1.000	1.000	1.000	0.982
1998	0.325	1.000	1.000	1.000	1.000	1.000
1999	0.325	1.000	1.000	1.000	1.000	1.000
2000	0.325	1.000	1.000	1.000	1.000	1.000

Notes : Re-adjusted Table 8 by x1. 198847.

Table 12 Adjusted Transition Matrix for Projection of Primary School Students during 1985–2000, Using ER 2.

Year	G1	G2	G3	G4	G5	G6
1985	1.976	0.960	0.868	0.785	0.722	0.650
1986	1.997	0.972	0.890	0.809	0.746	0.675
1987	2.020	0.985	0.911	0.833	0.771	0.701
1988	2.036	0.997	0.933	0.857	0.796	0.727
1989	2.051	1.000	0.956	0.881	0.822	0.753
1990	2.066	1.000	0.969	0.906	0.848	0.780
1991	2.078	1.000	0.980	0.931	0.874	0.808
1992	2.083	1.000	0.990	0.957	0.901	0.836
1993	2.086	1.000	1.000	0.983	0.928	0.864
1994	2.086	1.000	1.000	1.000	0.955	0.893
1995	2.086	1.000	1.000	1.000	0.975	0.922
1996	2.086	1.000	1.000	1.000	0.988	0.952
1997	2.086	1.000	1.000	1.000	1.000	0.982
1998	2.086	1.000	1.000	1.000	1.000	1.000
1999	2.086	1.000	1.000	1.000	1.000	1.000
2000	2.086	1.000	1.000	1.000	1.000	1.000

Notes : Re-adjusted Table 9 by × 1. 179932.

Table 13 Adjusted Transition Matrix for Projection of Primary School Students during 1985–2000, using ER3.

Year	G1	G2	G3	G4	G5	G6
1985	0.988	0.960	0.868	0.785	0.722	0.650
1986	0.998	0.972	0.890	0.809	0.746	0.675
1987	1.008	0.985	0.911	0.833	0.771	0.701
1988	1.015	0.997	0.933	0.857	0.796	0.727
1989	1.022	1.000	0.956	0.881	0.822	0.753
1990	1.029	1.000	0.969	0.906	0.848	0.780
1991	1.034	1.000	0.980	0.931	0.874	0.808
1992	1.036	1.000	0.990	0.957	0.901	0.836
1993	1.038	1.000	1.000	0.983	0.928	0.864
1994	1.038	1.000	1.000	1.000	0.955	0.893
1995	1.038	1.000	1.000	1.000	0.975	0.922
1996	1.038	1.000	1.000	1.000	0.988	0.952
1997	1.038	1.000	1.000	1.000	1.000	0.982
1998	1.038	1.000	1.000	1.000	1.000	1 000
1999	1.038	1.000	1.000	1.000	1.000	1.000
2000	1.038	1.000	1.000	1.000	1.000	1.000

Notes : Re-adjusted Table 10 by ×1. 179932.

10. The projected number of primary school students by grade and by cohort is obtained by multiplying the final adjusted transition of required age groups by population aged 6–8 years to Tables 11 and 12 and population aged 6–11 years to Table 13. The results are shown in Tables 14,15 and 16 respectively.

Since Table 16 involves the ratio of all primary school students to the proportion aged 6–11 years and its results are most readily interpretable and consistent with the cohort approach adopted, and thus selected to be the final output of the study.

It is significant to note that the projected number of students is based on the regression relationship between A_k and initial R_0 whose numerator may differ from covers a range of age group, which the number of students who first enter the school system. Furthermore if one allows for the standard error of estimate in using regression estimation, the estimated values should be read to be within the bracket of variance. Any estimated values that seem unrealistic should be adjusted accordingly but must be within the bracket of the variance. In term of our problems, the projected number of students must be readjusted such that it does not exceed the number of eligible population. If one does not wish to adjust the estimated number, the number of eligible population used must be comparable to the numerator of the R ratio used in the regression estimate. Table 17 shows the estimated value before and after adjusted for plus and minus standard error of estimate, and the adjusted estimated number of students.

Table 14 Projected Number of Total Primary School Students.

14.1 Low Projection

Year	G1	G2	G3	G4	G5	G6	Total
1985	1375	1348	1179	947	551	365	5766
1986	1350	1337	1200	954	707	372	5919
1987	1324	1329	1218	999	735	495	6101
1988	1306	1320	1241	1044	795	534	6240
1989	1289	1306	1262	1093	858	599	6407
1990	1273	1289	1265	1143	927	669	6566
1991	1241	1273	1263	1178	999	749	6703
1992	1222	1241	1260	1208	1061	835	6827
1993	1204	1222	1241	1238	1121	917	6943
1994	1191	1204	1222	1241	1183	1001	7041
1995	1178	1191	1204	1222	1210	1091	7095
1996	1153	1178	1191	1204	1207	1152	7084
1997	1129	1153	1178	1191	1204	1185	7039
1998	1105	1129	1153	1178	1191	1204	6959
1999	1082	1105	1129	1153	1178	1191	6837
2000	1059	1082	1105	1129	1153	1178	6706

14.2 Medium Projection

Year	G1	G2	G3	G4	G5	G6	Total
1985	1375	1348	1179	947	551	365	5765
1986	1350	1337	1200	953	707	372	5918
1987	1323	1329	1218	999	735	495	6100
1988	1305	1320	1241	1044	795	534	6238
1989	1289	1305	1261	1093	858	599	6405
1990	1272	1289	1265	1143	927	669	6564
1991	1247	1272	1262	1178	999	749	6706
1992	1233	1247	1259	1208	1061	835	6842
1993	1221	1233	1247	1237	1120	917	6976
1994	1214	1221	1233	1247	1182	1001	7098
1995	1207	1214	1221	1233	1216	1090	7182
1996	1192	1207	1214	1221	1218	1157	7210
1997	1177	1192	1207	1214	1221	1196	7208
1998	1162	1177	1192	1207	1214	1221	7173
1999	1147	1162	1177	1192	1207	1214	7099
2000	1132	1147	1162	1177	1192	1207	7017

Notes : Using ER1 With Adjustment for 100% completeness of student population.

Table 15 Projected Number of Total Primary School Students.

15.1 Low Projection

Year	G1	G2	G3	G4	G5	G6	Total
1985	1564	1555	1378	1109	678	445	6728
1986	1515	1521	1383	1114	828	458	6818
1987	1466	1492	1386	1151	859	580	6934
1988	1433	1462	1392	1187	917	624	7015
1989	1403	1433	1397	1227	976	691	7126
1990	1373	1403	1388	1266	1040	761	7232
1991	1330	1373	1374	1293	1106	840	7317
1992	1307	1330	1360	1315	1164	925	7400
1993	1285	1307	1330	1336	1220	1006	7484
1994	1271	1285	1307	1330	1276	1089	7559
1995	1257	1271	1285	1307	1297	1177	7595
1996	1231	1257	1271	1285	1291	1235	7571
1997	1205	1231	1257	1271	1285	1268	7518
1998	1180	1205	1231	1257	1271	1285	7430
1999	1155	1180	1205	1231	1257	1271	7300
2000	1131	1155	1180	1205	1231	1257	7160

15.2 Medium Projection

Year	G1	G2	G3	G4	G5	G6	Total
1985	1564	1555	1377	1108	678	445	6727
1986	1515	1521	1383	1114	827	458	6817
1987	1466	1492	1386	1151	859	580	6933
1988	1432	1462	1392	1187	917	624	7014
1989	1402	1432	1397	1227	976	691	7124
1990	1373	1402	1387	1266	1040	761	7229
1991	1336	1373	1373	1292	1106	840	7321
1992	1319	1336	1359	1314	1164	924	7416
1993	1304	1319	1336	1335	1219	1006	7519
1994	1297	1304	1319	1336	1275	1089	7620
1995	1289	1297	1304	1319	1303	1176	7688
1996	1272	1289	1297	1304	1303	1241	7705
1997	1256	1272	1289	1297	1304	1280	7698
1998	1240	1256	1272	1289	1297	1304	7659
1999	1225	1240	1256	1272	1289	1297	7579
2000	1209	1225	1240	1256	1272	1289	7492

Notes : Using ER2 With Adjustment for 100% completeness of student population.

Table 16 Projected Number of Total Primary School Students.

16.1 Low Projection

Year	G1	G2	G3	G4	G5	G6	Total
1985	1570	1563	1387	1117	687	450	6774
1986	1517	1526	1390	1122	834	464	6853
1978	1465	1494	1391	1157	865	584	6957
1988	1429	1461	1395	1192	922	629	7026
1989	1397	1429	1396	1229	979	694	7125
1990	1365	1397	1385	1265	1042	764	7218
1991	1329	1365	1369	1289	1106	842	7299
1992	1312	1329	1351	1309	1161	924	7387
1993	1297	1312	1329	1328	1215	1004	7484
1994	1290	1297	1312	1329	1268	1085	7581
1995	1283	1290	1297	1312	1296	1170	7647
1996	1259	1283	1290	1297	1296	1234	7658
1997	1235	1259	1283	1290	1297	1273	7637
1998	1212	1235	1259	1283	1290	1297	7576
1999	1190	1212	1235	1259	1283	1290	7469
2000	1168	1190	1212	1235	1259	1283	7347

16.2 Medium Projection

Year	G1	G2	G3	G4	G5	G6	Total
1985	1570	1563	1387	1117	687	451	6774
1986	1517	1526	1390	1122	834	464	6852
1978	1464	1494	1391	1157	865	584	6956
1988	1428	1460	1394	1192	922	629	7024
1989	1396	1428	1396	1229	979	694	7122
1990	1364	1396	1384	1265	1041	764	7214
1991	1332	1364	1367	1289	1105	841	7299
1992	1319	1332	1350	1308	1160	924	7394
1993	1309	1319	1332	1327	1214	1003	7503
1994	1306	1309	1319	1332	1267	1084	7617
1995	1303	1306	1309	1319	1299	1169	7704
1996	1288	1303	1306	1309	1303	1237	7745
1997	1274	1288	1303	1306	1309	1280	7760
1998	1260	1274	1288	1303	1306	1309	7740
1999	1246	1260	1274	1288	1303	1306	7677
2000	1232	1246	1260	1274	1288	1303	7603

Notes : Using ER3 With Adjustment for 100 % completeness of student population.

Table 17 Weight for adjusted lower bound and upper bound of each projected number of Primary School Students at 95% confident interval.

Year	ER1(L)	ER1(U)	ER2(L)	ER2(U)	ER3(L)	ER3(U)
1985	0.737	1.263	0.913	1.087	0.917	1.083
1986	0.678	1.322	0.897	1.103	0.902	1.098
1987	0.615	1.385	0,881	1.119	0.886	1.114
1988	0.552	1.448	0.865	1.135	0.871	1.129
1989	0.504	1.496	0.854	1.146	0.861	1.139
1990	0.453	1.547	0.842	1.158	0.850	1.150
1991	0.415	1.585	0.835	1.165	0.843	1.157
1992	0.392	1.608	0.829	1.171	0.837	1.163
1993	0.382	1.618	0.827	1.173	0.835	1.165
1994	0.382	1.618	0.827	1.173	0.835	1.165
1995	0.382	1.618	0.827	1.173	0.835	1.165
1996	0.382	1.618	0.827	1.173	0.835	1.165
1997	0.382	1.618	0.827	1.173	0.835	1.165
1998	0.382	1.618	0.827	1.173	0.835	1.165
1999	0.382	1.618	0.827	1.173	0.835	1.165
2000	0.382	1.618	0.827	1.173	0.835	1.165

Notes :

$$ERi\,(L) = \frac{W_i - (t_{.025} \times S \times SQRT[\frac{1}{n} + \frac{(Ai - M(A))^2}{Saa}])}{W_i}$$

$$ERi\,(U) = \frac{W_i + (t_{.025} \times S \times SQRT[\frac{1}{n} + \frac{(Ai - M(A))^2}{Saa}])}{W_i}$$

When W_i = Estimated Ratio of Each Projection.

$t_{.025}$ = Critical Value of t Distribution with n – 2 Degree of Freedom and probability value .025.

S = Standard error of W_i

Ai = A value of year i.

M(A) = Mean of A – vector.

Saa = Standard Variation of A–vector.

SQRT = Square root.

n = Number of data points or years.

7. Summary and Conclusion

Table 16 shows that during the Sixth Five–Year Plan, if the population grows according to the medium level of projection, the number of primary school students will continue to increase from 6.9 million to 7.3 million with an annual decrease in absolute number. The medium and low–levels of population projections produce an insignificant difference in the number of projected primary school students. In fact during the final year of the Plan, the two levels of population projection give about the same number of projected students. However, the difference will become slightly greater during the Seventh Five–Year Plan. It should be noted that the results of projections are determined by a combined effect of both the size of eligible population and the transition matrix. If there is a significant change in the educational system, indicated by the number of years student stay in the system, or in population growth rate, the diferrence in the projected number of school students between the medium and low levels of population projections will vary accordingly.

It is significant to note that if the trend in retention rates by grade continues, the goal of providing 6 years of compulsory education to all eligible school age population will be unlikely to be achieved during the Sixth Plan. Analysis of data has shown that the average number of years in school of the primary school students in 1980 is 4.35 and in 1984 is 4.96 years. This means that school age population, once they enter the compulsory education system, receive less than 5 years of education. If the trend continues it will be the year 1994 when the primary school age population will receive 6 full years of primary education.