

CENTRO LATINOAMERICANO DE DEMOGRAFIA

COMPARISON BETWEEN THE UNITED NATIONS
POPULATION PROJECTIONS FOR LATIN AMERICA
AND POPULATION ESTIMATES, 1950-1980.

Ashraf K. Kayani

CELADE - SISTEMA DOCPAL
DOCUMENTACION
SOBRE POBLACION EN
AMERICA LATINA

Latin American Demographic Centre
December 3, 1979
Santiago, Chile

CENTRO LATINOAMERICANO DE DEMOGRAFIA

COMPARISON BETWEEN THE UNITED NATIONS POPULATION PROJECTIONS FOR LATIN AMERICA AND POPULATION ESTIMATES, 1950-1980.

Ashraf K. Kayani

We attempt to compare population projections prepared by the United Nations (U.N.) in the 1950's with the "actual" estimates for the countries and the regions of Central (including Mexico) and South America. The comparisons between the two are made in terms of (a) base population used in the projections (1950) and the actual population in 1950, (b) the projected and the estimated population for 1980 and (c) the projected and the estimated rates and numbers of births, deaths and migration (including the rates of growth) over the 30 year period of the projections (1950-1980). Our analysis is simple and straightforward. However, the present study may serve as a useful supplement, though in an indirect way, to the work of Keyfitz (1979).

First, we provide a general background for the projections and the "actual" estimates from 1950 to 1980. Since the publications on the projections do not state birth and death rates or numbers of births and deaths, the method through which these rates and numbers are derived from the projections is briefly described. Finally, we present the comparisons between the projected and the actual parameters.

General background of the projections and the "actual" estimates.

In Population Studies N°16 and 21, the U.N. (1954 and 1955) published population projections for countries and regions of Latin America. In the region of Central America, Mexico was included. Population projections for the regions (Central America, Tropical and Temperate South America) were prepared by means of adding the projections of the countries in the region. With

the exception of Argentina and Venezuela, the populations of all countries were considered to be closed throughout the period of projection (1950 to 1980). In other words, effects of international migration were not taken into account. For Argentina and Venezuela, two sets of projections were prepared: one without migration and the other including the effects of migration.

Mortality was projected by constructing mortality curves based on a uniform scheme applicable to all countries of the world. From these mortality curves assumptions were derived and representative curves for each country were constructed. For birth projections three alternative assumptions of high, medium and low expectations were employed. Because of data limitations, it was assumed that the relative frequency of child-birth to females of different ages would conform to the same pattern in the countries where reliable data existed. Under this observation average relative age specific birth rates were computed. These rates were further reduced to a simple expression, by assigning relative constants to females by age (for details, see U.N. 1954: 28-29). The base population (1950) used in the projections was either estimated or projected depending upon the availability and quality of data at that time.

Using the cohort survival method, the projections under the three assumptions were prepared for each country. It was recommended that the projections with the medium assumption would more likely be near the "true" population in the future. In the present study, we compare the best available estimates (henceforth called actual estimates) with the medium projections for the countries and the regions.

Ideally, projected values should be compared with the true values. Unfortunately, the poor quality of data in Latin America does not permit us to do an ideal analysis. However, with the availability of better techniques now than in 1950, estimates prepared by CELADE can be assumed somewhere near the "true" values. This implies a belief that our present state of demographic knowledge is much better than 30 years ago when the projections were prepared. It is in this sense that we treat the recent estimates for the past and the present by CELADE as the actual ones.

CELADE (1978) prepared estimates of demographic parameters from 1950 to 1980 by utilizing information from two or more population censuses and national demographic surveys. Fertility estimates were prepared through the application of methods such as Brass (1975), own-children method (Cho, 1974) etc. From the censuses and surveys, information was available on indicators such as incidence of death among all children ever born, maternal orphanhood, and widowhood by death of first husband (Somoza, 1979:129). Depending on the availability of data on all or some of these indicators for an individual country, mortality estimates were prepared by the methods developed by Brass (1975); Feeney (1977), Brass and Hill (1974) and Hill (1976). Estimates of net migration were prepared from census information only. They are believed to be less reliable than those for fertility and mortality.

Methodology

Assumed numbers of births and deaths or birth and death rates are not given in the publications. For every country only "standardized" birth rates for two time intervals (for 1950/1955 and 1975/1980) are given. Projections by age and sex for each country are given for every five years from 1950 to

1980. From the projections, the projected birth and death rates are derived as follows:

Using the geometric method and population totals for a country at two points of time (five-year interval), an average annual growth rate is calculated. The "standardized" birth rates from 1950 to 1980 are interpolated in the light of the assumptions given in the publications (U.N., 1954 and 1955). The accuracy of the method is tested by applying the interpolated birth rate and growth rate to the population total at time t (for every year) to get the population total at $t+5$.

By using the interpolated birth rates and growth rates, the number of births during every five-year time interval are estimated. The number of births for the five years are added to population at time t (P_t). Population at time $t+5$ (P_{t+5}) is subtracted from the initial population plus the total births ($P_t + \text{total births}$), to get the number of deaths during the five-year period. Total numbers of births, deaths, average annual growth rates from 1950 to 1980, base population in 1950 and the projected population in 1980 under the medium assumption are given in Appendix A along with the comparative actual estimates. Actual estimates from 1950-1980 are taken from CELADE (1978).

Comparisons between the projected and the actual parameters

Table 1 shows the ratios of the projected to the actual demographic parameters from 1950 to 1980. If the ratios is more than 1.00 the projections overstated, and if the ratio is less than 1.00 they understated, a parameter during the 30 years. As evident from Table 1, the base population (1950) used in the projections was over or under the actual population in 1950 for almost all the countries (excepting Argentina, Brazil and

Colombia). The largest discrepancies in 1950 populations are found to be for Bolivia (about 12 percent higher than the actual one) and Uruguay (10 percent higher) while for Panama the base population used in the projections was 10 percent lower than the actual one.

Ratios of projected to actual number of births and deaths show that generally the projections implied less number of births and more number of deaths than those actually observed for the period. Ratios of projected to actual births show that projected births are much lower than actual births for almost all countries of Central America and Mexico. For example, for Honduras about 40 percent of the births were missed in the projections, for El Salvador 34 percent, for Nicaragua 28 percent, for Mexico 24 percent, for Panama 22 percent, etc. In terms of actual numbers, the projections missed the following numbers of births during the 30 years: 13 794 693 for Mexico, 1 400 121 for Honduras, 1 448 885 for El Salvador and 73 892 for Nicaragua.

In South American countries births were missed for Venezuela (18 percent), for Chile and Ecuador (12 percent) and for Brazil (10 percent). For Colombia and Argentina, projected births were within the range of 1 percent of actual births. For Peru births were over-projected by 9 percent (mainly due to a larger base population). For the rest of the countries of South America the projected births were lower than the actual births by 2 to 7 percent.

The ratios of projected to actual number of deaths show that, with the exception of few countries, the projections implied significantly higher or lower numbers of deaths than the actually occurred. For Argentina, Colombia and Ecuador the projected number of deaths was almost equal to actual deaths. Projected deaths were higher by 39 percent for Brazil, 18 percent

for Venezuela, 5 percent for Chile, 14 percent for Uruguay, 7 percent for Mexico and 10 percent for Guatemala. On the other hand, they were lower than actual deaths by 27 percent for Bolivia, 12 percent for Peru, 10 percent for Paraguay, 6 percent for Costa Rica, 33 percent for El Salvador, 38 percent for both Honduras and Nicaragua and 16 percent for Panama.

Ratios of projected to actual population in 1980 are given in table 1 (columns 3 and 6). In column 3 the ratios of projected population in 1980 to the estimated population are given. In column 6 we added or subtracted the actual net migrants to the projected figures for each country. In column 6, we show what effects net migration would have had on the ratios in 1980 had the projections included the migration aspect correctly.

From column 3, we find that, with the exception of five countries, projected total population is lower than the estimated population. Population in 1980 was underprojected by 17 percent for Brazil, 11 percent for Ecuador, 24 percent for Venezuela, 3 percent for Argentina, 11 percent for Chile, 21 percent for Mexico, 16 percent for Costa Rica, 21 percent for both El Salvador and Guatemala, 23 percent for Honduras, 12 percent for Nicaragua and 16 percent for Panama. For the rest of the countries population in 1980 was over projected, the highest being for Bolivia (19 percent).

Ratios in column 6 include net migrants in the numerator. Effects of fertility and mortality of the migrants are not included. Comparisons between the columns 3 and 6 show the effects on the projections (everything else being the same) with migration correctly incorporated. For example, the projections for bolivia would have been better by about 4 percentage points than they were without migration. Ratios for Brazil, Colombia, Ecuador, Peru, Chile, Costa Rica and Guatemala would not have changed much.

Projected figures in 1980 for Venezuela would have improved by 6 percentage points. With migration, projections for Argentina would have a ratio of 1.00. Projections for Mexico, El Salvador, Honduras, Nicaragua and Panama would have been worse than with the closed model actually used. In other words, the inclusion of the migration component would have improved the projected totals in 1980 for some countries, but for most countries the projected totals would have been further away from the actual estimates because of negative net migration in these countries. For some countries where migration was small, it would not have made any difference.

We know that the number of births and deaths in the projections are the result of the assumed birth and death rates and the base population. Therefore, it is important to compare the projected and the actual vital rates. Table 2 demonstrates the ratios of projected to actual average annual birth, death and growth rates. These ratios suggest that for South America the projected annual birth rates are within a 4 percent range of the actual ones for all but three countries. The three exceptions are: Bolivia, Paraguay and Uruguay. Projected annual death rates, on the other hand, for the same region are either extremely high or extremely low for many countries. For example, the death rate for Bolivia was underprojected by about 35 percent, for Brazil and Venezuela death rates were overprojected by 58 percent and 37 percent, respectively.

For Central America including Mexico, birth rates in the projections are lower from the actual ones by a range of 10 to 30 percent for all countries. Death rates were overprojected for Mexico by 24 percent, for Costa Rica by 7 percent and for Guatemala by 27 percent. For the rest of the

rest of the countries of Central America the projected death rates were underprojected: 5 percent for Panama, 25 percent for El Salvador, 32 percent for Honduras and 33 percent for Nicaragua.

It is interesting to see that where the projected birth rates and death rates have extreme deviations from the actual ones, the projected rate of growth is relatively closer to the actual rate. This is mainly due to the cancellation factor. For example, even if the assumed birth and death rates are much higher or lower than the actual rates, the difference between the two projected rates (birth rate-death rate) can still produce a rate of growth equal to the actual one.

Table 3 summarizes the results of the projections and the actual estimates for the regions. On the whole, for Central and South America the projections started with base populations that were about 1.5 percent less than the actual populations in 1950. After 30 years (in 1980) the projected total population is about 12.5 percent lower than the actual one. In other words, the projection was off target by 41.43 million. For the entire region, births implied by the projections are about 12 percent lower and deaths about 12 percent higher than the actual ones. Within the entire region projections for South America (Tropical plus Temperate) fared better than those for Central America, excepting projections of the number of deaths. The projected population for South America was lower by 10 percent in 1980, and that for Central America was lower by 21 percent, when compared with the actual estimates. Within South America the projections were relatively better for the Temperate region than those for the Tropical.

Discussion.

So far, we have discussed the degree to which the population projections over or understated the individual parameters in comparison with the actual estimates. Projection results can be lower or higher than the actual estimates due to (a) differences in the base population and the age structure, (b) differences between the assumed and the actual fertility and/or mortality rates, (c) differences between migration assumptions and (d) differences due to a combination or all of the above mentioned factors. Projections may result in the true future population because of correct assumed rates, base population etc., or the incorrect assumed rates with a cancellation effect.

To observe where and how the above mentioned factors affected the projections for Latin America, table 4, based on the first three tables, is presented. For 11 out of 17 countries the base population used in the projections is within 5 percent of the actual population. With the exception of Bolivia (15 percent above the actual population) other 6 countries range within 10 percent of the accurate figure. In 1980, the projections of population size are lower for 12 countries by 5 to 25 percent. For the other five countries, projected figures are higher with a range of 0 to 20 percent. Only for Argentina and Colombia did the projection change direction between 1950 and 1980, but in 1980 came very close to the actual estimates. Colombia's base population in 1950 was lower than the actual population but the projected figures in 1980 are higher by almost the same percentage points. In the case of Argentina the reverse happened.

From table 1 to 4, we see that all the factors mentioned above are relevant for the deviations of the projected parameters from the actual ones. Incorrect base population (depending upon the degree of incorrectness) may affect the projections more than incorrect birth and death rates. For example, the base population used in the projections for Bolivia was about 15 percent higher than the actual population. Births, deaths and their respective rates were underprojected. Despite all this, the projected population for Bolivia in 1980 is about 20 percent higher than the actual estimate. It should also be pointed out that despite the fact that the birth and death rates for Bolivia were lower in projections, the rate of growth (average over 30 years) remained higher than the actual growth rate by about 10 percent.

We also find that the degree of incorrectly projected death rates has relatively lesser effect on the projections than incorrectly projected birth rates. The death rate for Brazil was 60 percent higher than the actual death rate. Projected birth rates were within an acceptable range. Because of the low base population number of births were underprojected by about 10 percent (Table 4). During the thirty year period, the projected population was lower from the actual by about 15 percent (after taking the effects of initial difference into account). On the contrary, Peru started with a base population 6 percent higher, births were overprojected by 9 percent, deaths were underprojected by 12 percent but projected population in 1980 was about 8 percent higher than the actual one (after taking out the

difference between the base population in 1950 and the actual population in 1950). Another example of births having larger effects than deaths is the case of Mexico.

Effects of the relatively correct use of the rates and the base population can be seen in cases of Argentina and Colombia (Table 1). If the migration component was introduced in the projections, the projected population in 1980 for Argentina would have been exactly equal to the actual one. Effects of an incorrect base population and incorrect rates are evident from table 4 for the countries of Central America. Effects of incorrect rates which, however, partially cancel one another can be seen for Paraguay and Uruguay especially and even in the rates of growth for most of the other countries (table 2).

Table 1

RATIOS OF PROJECTED (1950-1980) TO ACTUAL
DEMOGRAPHIC PARAMETERS (1950-1980).

Country	1950 base population used in projections % actual population in 1950	Projected % actual population in 1980	Projected # births 1950-1980 % actual # births 1950-1980	Projected # deaths 1950-1980 % actual # deaths 1950-1980	Projected [±] actual net migration in 1980 % actual population in 1980
Bolivia	1.1173	1.1906	0.9830	0.7323	1.1529
Brazil	0.9825	0.8349	0.8999	1.3927	0.8393
Colombia	0.9709	1.0184	1.0126	1.0195	0.9933
Ecuador	0.9543	0.8944	0.8889	1.0038	0.8825
Peru	1.0590	1.1461	1.0919	0.8882	1.1461
Venezuela	0.9670	0.7686	0.8263	1.1845	0.8262
Argentina	1.0022	0.9699	0.9917	1.0245	1.0010
Chile	0.9432	0.8897	0.8814	1.0537	0.8716
Paraguay	1.0190	1.0490	0.9335	0.8987	0.9739
Uruguay	1.1048	1.0985	0.9692	1.1374	1.0249
Mexico	0.9609	0.7928	0.7628	1.0714	0.7742
Costa Rica	0.9381	0.8366	0.8042	0.9389	0.8366
El Salvador	0.9566	0.7966	0.6607	0.6711	0.7664
Guatemala	0.9461	0.7931	0.8271	1.1001	0.7931
Honduras	1.0193	0.7695	0.6006	0.6159	0.7451
Nicaragua	0.9530	0.8789	0.7181	0.6243	0.8295
Panama	0.9530	0.7889	0.7181	0.6243	0.8295
Panama	0.9080	0.8425	0.7791	0.8411	0.8109

Table 2

RATIOS OF PROJECTED TO ACTUAL AVERAGE ANNUAL RATES. 1950-1980

Country	Birth rate	Death rate	Rate of growth
Bolivia	0.8601	0.6533	1.1083
Brazil	1.0259	1.5785	0.8270
Colombia	1.0360	1.0358	1.0750
Ecuador	0.9817	1.0931	0.9524
Peru	0.9975	0.8128	1.1136
Venezuela	0.9889	1.3746	0.7994
Argentina	1.0187	1.0490	0.9342
Chile	0.9715	1.1585	0.9100
Paraguay	0.9018	0.8603	1.0485
Uruguay	0.9019	1.0438	0.9896
Mexico	0.8982	1.2400	0.8106
Costa Rica	0.9311	1.0667	0.8952
El Salvador	0.7650	0.7404	0.8106
Guatemala	0.9772	1.2754	0.8154
Honduras	0.7018	0.6825	0.7298
Nicaragua	0.7865	0.6700	0.9233
Panama	0.8975	0.9489	0.9242
.....			
Central America	0.8510	0.9463	0.8442
Tropical S. America	0.9817	1.0914	0.9793
Temperate S.America	0.9485	1.0279	0.9706
South America	0.9684	1.0660	0.9758
Central & South	0.9201	1.0167	0.9216

Table 3

ACTUAL AND PROJECTED NUMBER OF BIRTHS AND DEATHS BY REGIONS, 1950-1980

Region	Births		Deaths		Initial population (1950)		Population in 1980	
	Projected	Actual	Projected	Actual	Used in projections	Actual	Projected	Actual
Central America including Mexico	59 049 246	78 210 000	19 572 396	19 640 000	34 264 300	35 701 000	73 740 700	92 557 000
Tropical South America <u>1/</u>	148 544 331	159 400 000	52 663 331	43 770 000	82 681 000	83 485 000	178 562 000	199 574 200
Temperate South America <u>2/</u>	26 036 376	27 320 000	10 237 376	9 915 000	26 754 000	26 806 000	42 553 000	44 153 758
South America	174 580 707	186 720 000	62 900 707	53 685 000	109 435 000	110 291 000	221 115 000	243 727 958
Total (South & Central+Mexico)	233 629 953	264 930 000	82 473 103	73 325 000	143 699 300	145 992 000	294 855 700	336 284 958

Region	Ratios of projected to actual			
	Births	Deaths	Population in 1950	Population in 1980
Central America including Mexico	0.7550	0.9966	0.9598	0.7967
Tropical South America <u>1/</u>	0.9319	1.2032	0.9904	0.8947
Temperate South America <u>2/</u>	0.9530	1.0325	0.9981	0.9637
South America	0.9350	1.1717	0.9922	0.9072
Total South and Central+Mexico	0.8819	1.1248	0.9843	0.8768

1/ Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela

2/ Argentina, Chile, Paraguay and Uruguay

Table 4

DEVIATIONS OF PROJECTED PARAMETERS FROM THE
ACTUAL ONES IN PERCENTAGE POINTS 1/ FROM 1950-1980.

Country	Base population %	Population in 1980 <u>2/</u> %	Births %	Deaths %	Birth rate %	Death rate %
Bolivia	+15	+20	- 5	-30	-15	-35
Brazil	- 5	-20	-10	+40	+ 5	+60
Colombia	- 5	+ 5	+ 5	+ 5	+ 5	+ 5
Ecuador	- 5	-15	-15	+ 5	- 5	+10
Peru	+10	+15	+10	-15	- 5	-20
Venezuela	- 5	-25	-20	+20	- 5	+40
Argentina	+ 5	- 5	- 5	+ 5	+ 5	+ 5
Chile	-10	-15	-15	+ 5	- 5	+15
Paraguay	+ 5	+ 5	-10	-10	-10	-15
Uruguay	+10	+10	- 5	+15	-10	+ 5
Mexico	- 5	-15	-25	+10	-20	+25
Costa Rica	-10	-20	-20	-10	-10	+10
El Salvador	- 5	-20	-35	-35	-25	-25
Guatemala	- 5	-25	-20	+10	- 5	+30
Honduras	- 5	-25	-40	-40	-30	-35
Nicaragua	- 5	-15	-30	-40	-25	-35
Panama	-10	-20	-25	-20	-20	- 5

1/ 5% = 0- 5%
10% = 6-10%
15% = 11-15%

⋮

60% = 56-60%

+ = overestimated
- = underestimated

2/ Column 4 of table 1.

APPENDIX A

Table A.1.

PARAMETER IMPLIED BY THE PROJECTIONS
(MEDIUM ASSUMPTIONS), 1950-1980.

Country	N° of births	N° of deaths	Base population in 1950	Projected population in 1980
			(in thousands)	
Bolivia	5 342 521	1 735 521	3 020	6 627
Brazil	87 657 066	34 106 066	51 976	105 527
Colombia	22 555 860	6 427 860	11 260	27 388
Ecuador	6 266 492	2 248 492	3 156	7 174
Peru	17 360 937	5 284 937	8 294	20 370
Venezuela	9 361 455	2 860 455	4 975	11 476
Argentina	15 029 437	5 967 437	17 188	26 250
Chile	6 936 737	2 802 737	5 745	9 879
Paraguay	2 417 780	602 780	1 397	3 212
Uruguay	1 652 422	864 422	2 424	3 212
Mexico	44 365 307	14 463 307	25 567	55 469
Costa Rica	1 375 214	328 164	804.9	1 851.5
El Salvador	2 821 155	855 715	1 855.9	3 821.3
Guatemala	5 371 774	2 414 774	2 802.1	5 759.4
Honduras	2 104 879	692 879	1 428.1	2 840.1
Nicaragua	1 885 108	540 008	1 056.9	2 402.0
Panama	1 125 849	277 549	749.1	1 597.4

Table A.2.

ACTUAL PARAMETERS ESTIMATES BY CELADE, 1950-1980
(In thousands)

Country	N°of births	N°of deaths	Net migrants	Population in 1950	Population in 1980
Bolivia	5 435	2 370	-210	2 703	5 566.1
Brazil	97 410	24 490	+550*	52 901	126 389.2
Colombia	22 275	6 305	-675	11 597	26 894.3
Ecuador	7 050	2 240	- 95	3 307	8 021.3
Peru	15 900	5 950	0	7 832	17 772.9
Venezuela	11 330	2 415	+860	5 145	14 930.4
Argentina	15 155	5 825	+840	17 150	27 063.5
Chile	7 870	2 660	-200	6 091	11 104.3
Paraguay	2 590	670	-230	1 371	3 061.8
Uruguay	1 705	760	-215	2 194	2 924.1
Mexico	58 160	13 500	-1 300	26 606	69 965.0
Costa Rica	1 710	350	0	858	2 213.0
El Salvador	4 270	1 275	-145	1 940	4 797.0
Guatemala	6 495	2 195	0	2 962	7 262.0
Honduras	3 505	1 125	- 90	1 401	3 691.0
Nicaragua	2 625	865	-135	1 109	2 733.0
Panama	1 445	330	- 60	825	1 896.0

* Only during 1950-1955

Table A.3.

AVERAGE ANNUAL BIRTH AND DEATH RATES AND RATE OF GROWTH 1950-1980 (MEDIUM ASSUMPTION)

Country	Birth rate		Death Rate		Rate of growth	
	Projected	Actual	Projected	Actual	Projected	Actual
Bolivia	40.32	46.88	13.72	21.00	2.66	2.40
Brazil	39.59	38.59	15.69	9.94	2.39	2.89
Colombia	42.54	41.06	12.44	12.01	3.01	2.80
Ecuador	44.01	44.83	16.21	14.83	2.78	2.95
Peru	44.47	44.58	14.07	17.31	3.04	2.73
Venezuela	41.97	41.53	12.77	9.29	2.83	3.54
Argentina	23.40	22.97	9.20	8.77	1.42	1.52
Chile	30.70	31.60	12.50	10.79	1.82	2.00
Paraguay	37.83	41.95	9.73	11.31	2.81	2.68
Uruguay	19.50	21.62	10.00	9.58	0.95	0.96
Mexico	39.43	43.90	13.33	10.75	2.61	3.22
Costa Rica	37.16	39.91	8.96	8.40	2.82	3.15
El Salvador	35.15	45.95	10.75	14.52	2.44	3.01
Guatemala	45.05	46.10	20.75	16.27	2.43	2.98
Honduras	34.98	49.84	11.48	16.82	2.35	3.22
Nicaragua	39.09	49.70	11.39	17.00	2.77	3.00
Panama	34.14	38.04	8.54	9.00	2.56	2.77

REFERENCES

- Brass, William, 1975 Methods for estimating fertility and mortality from limited and defective data. Chapel Hill Laboratories for Population Statistics, University of North Carolina.
- Brass, W. and Hill, K. 1974 Estimating adult mortality from orphanhood. Paper presented at the International Population Conference. Liege.
- CELADE 1978 Boletín Demográfico N°22, Santiago, Chile, July.
- Cho, Lee-Jay, 1974 The own-children approach to fertility estimation: An elaboration. Paper presented at the International Population Conference, Liege.
- Feeney, Griffith 1977 Estimación de la tendencia de la mortalidad infantil a partir de información relativa a hijos sobrevivientes. Seminar at CELADE, Santiago.
- Hill, Kenneth 1976 Encuesta Demográfica Nacional de Honduras. Fascículo VII. Análisis de preguntas retrospectivas. CELADE. Series A, N°129, Santiago
- Keyfitz, Nathan 1979 Long-range projections: models, pitfalls, possible break-throughs. Published in U.N. Population Studies, N°67. (Prospects of Population: Methodology and Assumptions). New York, pp. 107-121.
- Somoza, Jorge L., 1979 Demographic projections for Latin American countries. Published in U.N. Population Studies N°67, New York, pp. 127-136
- United Nations 1954 The population of Central America (including Mexico), 1950-1980, Population Studies N°16, New York.
- United Nations 1955 The population of South America, 1950-1980. Population Studies, N°21, New York.