ECONOMIC AND POPULATION PROJECTIONS LARIMER-WELD REGION

**LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
LOVELAND, COLORADO**

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ECONOMIC AND POPULATION PROJECTIONS
LARIMER-WELD REGION
1975 - 2000

Prepared For:

Larimer-Weld Regional
Council of Governments

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1.0 EXECUTIVE SUMMARY--LWRCOG

The Larimer-Weld Regional Council of Governments has undertaken studies to develop population and employment information and projections on which to base planning activities in the Region. Population forecasts are important because they establish the future levels of activities upon which plans for facilities and services can be based. In the Larimer-Weld Region the largest component to population increases in recent years has resulted from employment opportunities.

The geographic area encompassed by the political boundaries of Larimer and Weld Counties (State Planning Region 2) in Northern Colorado has a highly diverse physical setting and economic base. This 6,618 square mile-area supports highly productive irrigated agriculture and food processing industries, rapidly developing electronics and scientific instruments manufacturing industries, and is a major center for higher education and state and national government research services.

The area, because of its proximity to other influential urban areas along the Front Range including Denver and Boulder and the geographic configuration and economic diversity of the major municipalities of Fort Collins, Loveland, and Greeley, shows a set of complex interrelationships of economy and population.

The analytical tool which this region has selected for development of employment information is an input-output economic model. It provides a mechanism by which to assess the interdependence of the regional economy and determine the effects of economic growth scenarios in the region. The information is translated into employment which is then linked to a population projection methodology developed by the Colorado Division of Planning. For the period beginning in 1975 through 2000, the economic projections which have been formulated are the result of anticipated economic activity in four strongly influential sectors of the Larimer-Weld economy. These are livestock, food processing, electronics manufacturing, and government (including local, state and federal sources, assistance programs, and university research activities). The projections show the resulting growth directly attributable to changes in these sectors plus induced growth to, or from, other interdependent sectors of the economy.

A summary of results of combining locally generated economic activity and employment projections and the Colorado Division of Planning population projection technique is displayed below.

Larimer-Weld Region	Year					
	1975[1]	1980[2]	1985[2]	1990[2]	1995[2]	2000[2]
Total Population	228,600	287,500	334,600	377,900	419,150	456,300
Employment	106,850	135,430	161,150	182,840	203,050	220,450

1. U.S. Bureau of Census, May 1977, Preliminary estimate.

2. Larimer-Weld Regional Council of Governments, July 1977; figures rounded to nearest 10.

The employment projections reflect only anticipated projected economic activity of the existing major industry in the region. They do not consider the location of new major industry which could add significant employment and ultimately population to the region. The projections in the economic growth scenario are therefore considered conservative and the population projection of 456,300 may be easily surpassed for the planning period. It is highly likely that a year 2000 population of over 500,000 would occur.

2.0 INTRODUCTION

The population of a region grows as a function of births, deaths, and net migration. During the first five years of this decade, the population of Larimer and Weld counties (State Planning Region 2) grew by an estimated 49,403 persons, from 179,197 in 1970 to 228,600 in 1975. This 27.6 percent population increase occurred as a result of 17,000 births, 7,400 deaths, and a net migration of 39,800.[1] Obviously, the most important component of Region 2's growth is net migration, accounting for 80.6 percent of its population gain.

The Colorado Division of Planning under State Law CRS (1973) 24-32-204 has the responsibility for the preparation, maintenance, and interpretation of population estimates, projections, and statistics for the entire State. Population estimates and projections for Region 2 are prepared by the Division of Planning on the basis of estimates of future births, deaths, and in migration. The tool used by the Division of Planning for this purpose is a computer simulation model which has been developed for the Division by the Business Research Division, Graduate School of Business at the University of Colorado in Boulder. The simulation model is a forecasting model which projects future populations of a study region on the basis of estimates of future births, deaths, and various elements of net migration. The calculation of births and

deaths is a fairly straight-forward which may be easily
accounted for through modification of data inputs and presents
no obvious problems unique to this region. Net migration
for employment, on the other hand, is determined on the
basis of an economic submodel which has several serious
faults, foremost of which is its failure to reflect special
local economic conditions.[2]

Because of the significance of net migration and the questionable
reliability of the State's calculation of this component of
population growth, the Larimer-Weld Regional Council of
Governments (LWRCOG) undertook the preparation of economic
and population projections which do recognize local conditions.
These projections were based upon an economic input-output
study of the region and a preliminary economic growth scenario
contained in that study.[3] The purpose of this study is to
refine those initial projections and to assess the reliability
of the new estimates.

2.1 APPROACH

The major emphasis of this study is on developing the economic
projections necessary for determining net migration. The
State's population model for calculating the effects on
population of estimated fertility and death rates is utilized.
The State's economic submodel, however, is replaced by the
Larimer-Weld input-output model. The linkage of the State's
model with the Larimer-Weld inputoutput model is illustrated
in Figure 2.1.

The State's population model consists of three major components.
First, changes in population due to births and deaths are
calculated utilizing fertility and survival rates for males
and females in 18 age groups. Next, the population total is
adjusted to reflect estimates of net retirement, military,
and college migration. Finally, the population total is
adjusted according to the calculation of net employment-
related migration. Net employment migration is calculated
in this study on the basis of economic projections developed
utilizing the Larimer-Weld input-output model.

2.2 INPUT-OUTPUT MODELING

Economic forecasting is at best a risky business. Of the
numerous methods available for making such projections,
input-output analysis represents the best.[4] Most forecasting
involves the projection of one or more time series. The
simplest method of this partial forecasting technique is to
fit a mathematical curve to an individual time series and
extrapolate this relation to some future date. The major
weakness of such a partial approach is that the individual
forecasts may not add up to a meaningful total. That is,
there is always a problem of possible inconsistencies when
individual time series are projected.

FIGURE 2.1

POPULATION AND ECONOMIC SUBMODEL INTERACTIONS
WITHIN EACH FORECAST PERIOD
(Linkage)
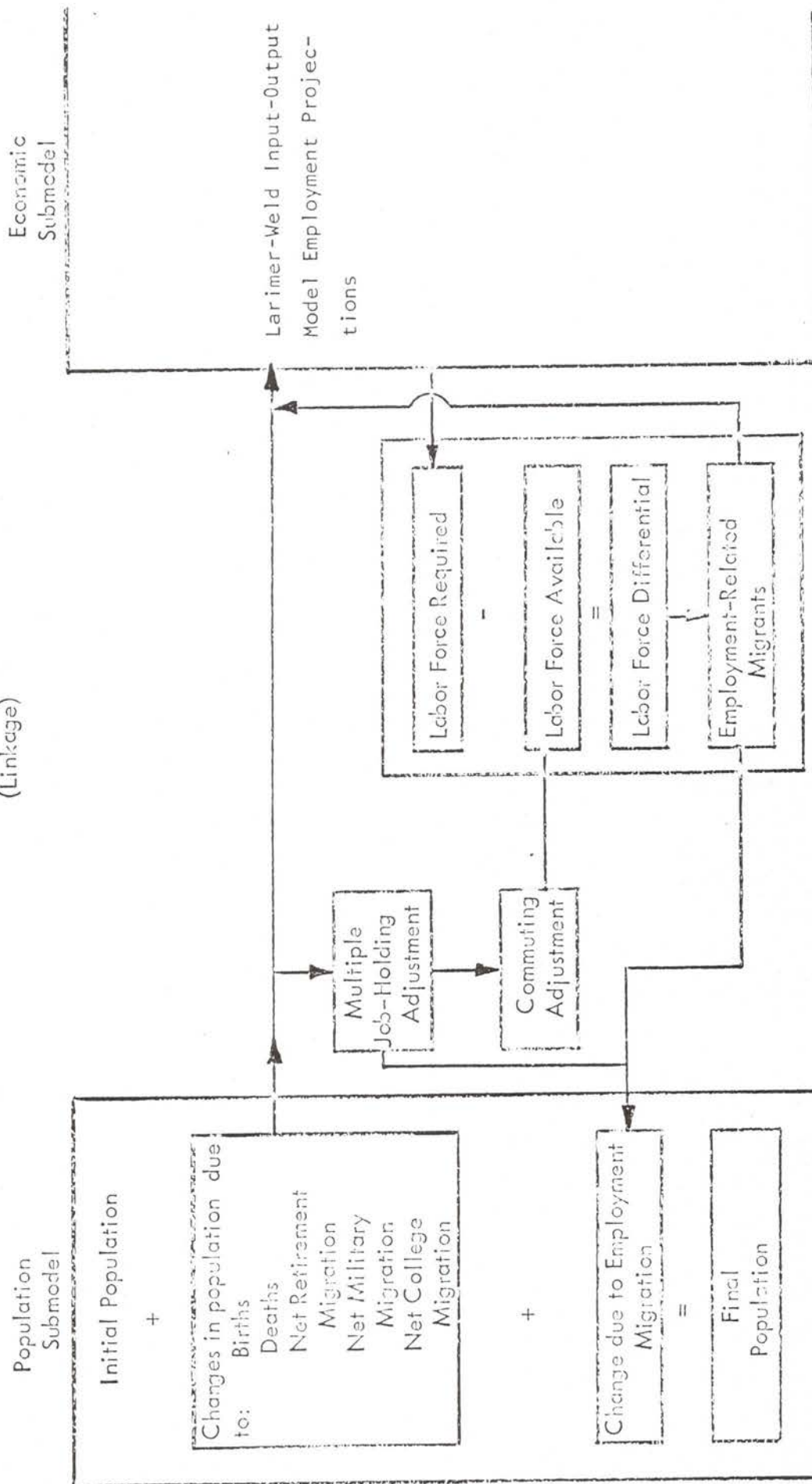
Source: Colorado Division of Planning

An input-output model, on the other hand, specifies how the output of each sector of the economy is distributed to all other sectors and, simultaneously, it specifies the inputs to each sector from all other sectors. Thus, when an input-output model is projected, the output of each sector is consistent with both the final and intermediate demands of all other sectors for its product. The projections are mutually consistent. While consistent projections do not guarantee correct ones, they do require the sum of the separate sector projections to be identical to the total projection. The correctness of the projections depends upon the accuracy of the assumptions upon which the projections are based.

The input-output model describes the interrelationships of the regional economy at a point in time. If the nature of these interrelationships are assumed to remain the same, then the effects on the regional economy of changes in the individual sectors of the economy can be projected with an input-output model. If one sector of the economy increases its sales outside the region (i.e., exports), then not only will this sector experience economic growth, but also other sectors of the economy which sell inputs to this sector will grow. Moreover, these supplying sectors will themselves demand more inputs so that other sectors will grow, thus inducing yet more growth. The total effect on the regional economy can be traced through with an input-output model and, thus, provide consistent economic projections.

Of course, the nature of the interrelationships of the regional economy will most likely not remain constant. New technologies will alter production processes, consumer tastes and preferences will change, and government policies will be modified. These changes may or may not radically affect the projections of the input-output model; the effects depend upon the nature and magnitude of the changes. This study does not attempt to model such changes, since, as is the case for all projection techniques, the unknown and the unknowable cannot be projected. On the other hand, such changes are not likely to affect short-run projections, since neither the changes nor the adjustments to them are instantaneous and may even have a self-cancelling effect. Moreover, while long-term projections would be affected by such changes, it is recognized that these projections and the assumptions upon which they are based should be periodically evaluated and updated to reflect such changes.

The Larimer-Weld input-output model, shown in Table 2.1, is projected on the basis of growth rate estimates provided by the major firms in the basic (i.e., primarily export) or growth producing sectors of the economy. These growth

TABLE 2.1   TRANSACTIONS TABLE, LARIMER-WELD REGIONAL ECONOMY, 1974 (in millions of dollars)[1]

	1 Livestock	2 Irrigated Agriculture	3 Dryland Agriculture	4 Food Processing	5 Mining	6 Metals and Electronics	7 Paper	8 Printing	9 Chemicals and Petroleum	10 Lumber and Wood	11 Miscellaneous Manufacturing	12 Utilities	13 Services	14 Trade	15 Education	16 Households	17 Government	18 Exports	19 Other Final Demand	20 Total Gross Output
1 Livestock	50.07	1.75	1.36	381.14	9.14	.21	.05	.01	.11		.03		.28	9.25	.25	4.37	1.34	38.49	.21	477.64
2 Irrigated Agriculture	51.98	6.01	.49	26.94	.31	4.07									.07	1.45	2.19	35.39	4.62	128.23
3 Dryland Agriculture	3.53		.05	1.62	.05	.08		.03	.02		.12	.12	.60	5.79	.11	.12	.70	8.93	1.09	17.48
4 Food Processing	22.01	.64	.05	1.05		1.05			.02	.59					.94	8.87		751.86	14.78	809.73
5 Mining				.65												.97	.16	23.33	1.16	36.21
6 Metals and Electronics				.40	.03	.84	.39	.20	.04	1.90	.34	.36	.09	1.20	.02			372.66	16.48	406.56
7 Paper				.08		.66			.07				.80		.29	.50		1.35	.91	2.70
8 Printing									.21									3.57	.02	10.70
9 Chemicals and Petroleum	.14	3.30	.16	.08	.12	.53			.11		.02	.01	.02			.24	.01	2.20	5.25	5.11
10 Lumber and Wood					.54	1.90					.04	.54	.04	3.50	.07	1.34	.03		.01	11.96
11 Miscellaneous Manufacturing				1.81	1.39	.34		.06	.06	.04	.01	.90	.59	.15	1.06	.24	.88	55.12	2.46	18.65
12 Utilities	7.11	1.91	.54	8.17		18.50			.04	.54	.90	7.09	13.00	29.79	.11	12.73	11.77			177.42
13 Services	15.51	5.99	1.83	.49	13.22	1.69	.80	4.86	.56	.04	.59	1.17	11.88	59.99	4.29	72.91	5.67	384.40	88.20	223.81
14 Trade	5.11	13.46	1.94	1.70	1.94	1.40	.09	.59	.43	3.50	.15	.66	2.90	107.44	1.21	377.05	6.08	2.05	504.14	994.20
15 Education	.19					1.87							1.45	.14	2.25	59.90		54.68	.19	180.86
16 Households	35.94	5.41	.94	33.78	2.46	75.29	.50		.86	.50	5.58	24.75	69.30	144.55	103.91	75.58	98.81	157.10	95.11	1,240.68
17 Government	10.07	2.71	.48	40.53	7.01	38.74		1.24		.03	.88	9.28	10.33	23.04	.05	165.05	159.34		162.38	409.98
18 Self Final Payments and Unallocated	2.13	50.88	8.97	10.29		17.74					2.17	31.06	39.62	145.85	7.61	129.96	55.64			360.35
19 Imports	273.85	36.15	.82	301.00		243.94	.80	3.50	2.86	4.74	7.86	102.92	74.34	467.16	57.90	329.76	46.59			2,220.20
20 Total Gross Output	477.64	128.23	17.48	809.73	36.21	406.56	2.70	10.70	5.11	11.96	18.65	177.42	223.81	994.20	180.86	1,240.68	409.98	1,891.01	1,029.70	8,072.66

[1] The Sectors referenced in this report are aggregated using 1972 Standard Industrial Classifications. Sector Identification is available in Volume 1: Future Economic Trends Input/Output Analysis: Interindustry Analysis and Economic Profile of the Larimer-Weld Region. December 6, 1976, by S. Lee Gray, Paul C. Huszar, and John R. McKean.

estimates were obtained in the spring of 1976 and were
aggregated (totaled) according to the share of the industrial
sector represented by the individual firms. There are
relatively few firms in the basic sectors of this regional
economy, so that it was possible to obtain growth estimates
from practically all of them. Moreover, these firms have
corporate planning departments which continually assess the
firm's future growth in this region within a regional,
national, and international perspective. Individual firm
growth estimates cannot be disclosed because of the confidential
nature of the data requested. However, the electronics and
precision instruments sector contains a sufficiently large
number of firms so that the firms providing growth estimates
can be revealed in order to illustrate the caliber and
national market influences of the firms. These firms are
Eastman Kodak, Woodward Governor, Hewlett-Packard, and
Teledyne Water Pik.

The results of projecting the estimated sector growth rates
were reviewed in the summer of 1977 by the firms originally
interviewed in the spring of 1976. The firms were asked to
assess the projections of both the dollar value of production
and the employment levels. The consensus of these firms was
that the projections are reasonable in light of their own
respective operations.

3.0 ECONOMIC PROJECTIONS

Four projections are calculated according to different sets
of assumptions which were jointly developed with the LWRCOG
staff. The estimates of growth obtained directly from the
firms in the basic sectors of the economy provide the nucleus
for all of the projections. The four projections are presented
in order of increasing complexity of their basic assumptions
and represent the development toward a complete projection
model. The purpose of the four projections is not to provide
a range of possible futures, but rather to identify the
contribution of each additional assumption to the total
projection. The projections are calculated in terms of 1974
dollar values. These values are then translated into employment
totals.

3.1 PROJECTION 1

The first projection assumes that growth in the region will
occur only in response to growth in the basic sectors of the
economy. These basic or export sectors are identified as
the livestock sector, the food processing sector, and the
electronics sector. The estimated growth rates of these
sectors were obtained directly from the major firms comprising
them and are shown in Table 3.1-A.

Table 3.1-A. Basic Sector Final Demand Growth Rates to the Year 2000[1]

Sector	Time Period				
	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
Livestock	0.020	0.020	-0.020	-0.020	0.020
Food Processing	0.060	0.050	0.040	0.020	0.010
Electronics	0.170	0.063	0.021	0.021	0.014

[1]
The declining growth rates of the electronics sector over time reflects the eventual final development of the firms in this relatively new sector in the regional economy. This is also true of the important livestock processing component of the food processing sector. The cyclical behavior of the livestock production sector reflects the historical patterns of this economically developed sector. In all cases, these growth estimates represent the best estimates of large, sophisticated local firms.

Growth in the other sectors of the economy including government, is assumed to occur as a function of increased exports by these three basic sectors. For example, as the electronics sector grows, it can be seen from Table 2.1 the Transactions Table that it will increase its purchases from the utilities sector and, thus, induce growth in that sector.

Table 3.1-B shows the resulting gross dollar output of projecting the Larimer-Weld input-output table (Table 2.1) with these assumptions. This table describes both the total effect of growth in the three basic sectors as well as the distributional effect on individual sectors of the regional economy. The total gross output of the region is projected to increase by nearly 72 percent over the 25-year period, from $8,072,660,000 in 1975 to $13,881,370,000 in 2000. Of the three basic sectors, the electronics sector would increase the most, growing by 271 percent from $406,560,000 in 1975 to $1,509,350,000 in 2000. Sectors with weak linkages to the growth sectors would grow only slightly, such as the mining, paper, and lumber sectors. On the other hand, growth would be induced in such sectors as utilities, services, trade, education, and government. For example, nearly 5 percent of the electronic's sectors expenditures are on utilities which contributes to that sector's projected 61 percent growth over the 25-year period. Moreover, while less than 0.5 percent of the total purchases of the electronics sector are from the education sector, more than 18 percent are from the household sector (i.e., labor). The household sector in turn makes over 6

TABLE 3.1-B. PROJECTION 1 OF TOTAL GROSS OUTPUTS (millions of dollars) [1]

	1975*	1980	1985	1990	1995	2000
Livestock	477.64	621.44	778.24	924.48	1008.46	1061.08
Irrigated Agriculture	128.23	154.05	182.15	208.97	224.49	233.74
Dryland Agriculture	17.48	19.08	20.82	22.48	23.44	24.02
Food Processing	809.73	1072.66	1359.56	1645.75	1813.12	1904.09
Mining	36.21	36.95	37.57	38.03	38.36	38.57
Electronics	406.56	855.74	1150.87	1273.76	1410.00	1509.35
Paper	2.70	2.82	2.91	2.96	3.01	3.04
Printing	10.70	12.59	13.94	14.63	15.28	15.73
Chemicals and Petroleum	5.11	6.79	8.22	9.24	9.96	10.44
Lumber	11.96	12.90	13.53	13.80	14.09	14.30
Miscellaneous Manufacturing	18.65	21.27	23.40	24.86	25.95	26.65
Utilities	177.42	215.69	244.54	261.66	275.89	285.51
Services	223.81	243.04	259.71	272.02	280.56	286.13
Trade	994.20	1047.70	1089.96	1117.28	1138.47	1152.54
Education	180.86	191.24	198.93	203.34	207.10	209.67
Households	1240.68	1374.28	1475.59	1536.35	1586.38	1620.16
Final Payments	3330.72	4033.40	4607.71	5002.85	5296.12	5486.37
Total Gross Output	8072.66	9921.65	11467.64	12572.47	13370.69	13881.37
Total Government Payments	360.35	442.29	505.81	545.96	577.91	598.95

[1] Note that these are actually 1974 values, but have been labeled 1975 in order to make the projection years consistent with those of the State. Projections, therefore, should somewhat underestimate the actual values for each projected year.

percent of its purchases from the education sector, thus partially inducing the education sector's projected 16 percent growth.

Employment projections are derived from Table 3.1-B by utilizing the employment coefficients shown in Table 3.1-C. Employment data in all but the agricultural sectors (i.e., livestock, irrigated agriculture, and dryland agriculture) and the education sector were obtained directly from computer tapes provided by the Colorado Division of Employment, which list employment by county and Standard Industrial Classification. The data are for the fourth quarter of 1973 and the first three quarters of 1974. Employment data in the irrigated and dryland agricultural sectors are based upon output per worker ratios for Colorado. Employment in education is based upon a previous sample of private and public educational institutions in the region, including elementary, secondary, and higher education.[5] The employment coefficients are in terms of numbers of workers per $1,000 of total output.

Table 3.1-D shows the projection of employment corresponding with the total gross output projections of Table 3.1-B. In addition to employment in the processing sectors shown in Table 3.1-C, employment in the final demand sectors is also calculated. Government employment is allowed to grow at the same rate as government payments. Employment in the finance, insurance, and real estate and the construction and ordinance sectors is assumed to grow at the rate of growth of final payments. Employment in livestock, irrigated agriculture and dryland agriculture is held constant reflecting the consensus of leading agriculturalists in the area that while the dollar value of agricultural production may rise, employment will not. Finally, the number of commuters is allowed to grow at the rate of employment growth estimated for Region 3 (i.e., the Denver Metropolitan Area) by the Colorado Division of Planning, since this is the predominate destination of these commuters.

Total employment in the two-county region is projected to grow from 106,848 persons in 1975 to 169,570 persons in 2000. Note that because of multiple job holdings these figures could be less. However, this consideration is adjusted for in the population projection model. The largest increase in employment is projected for the electronics sector with a growth of 273 percent over the 25-year period.

Table 3.1-C. Employment and Employment Per $1,000 of Total Output,
Larimer-Weld Regional Economy, 1974*

Sector	Total Employment	Employment Per $1,000 Output
Livestock	7,165	.015
Irrigated Agriculture	7,950	.062
Dryland Agriculture	559	.032
Food Processing	3,402	.004
Mining	1,159	.032
Electronics	6,884	.017
Paper	133	.049
Printing	645	.060
Chemicals and Petroleum	100	.020
Lumber and Wood	431	.036
Miscellaneous Manufacturing	867	.046
Utilities	2,531	.014
Services	7,540	.034
Trade	14,243	.014
Education	17,905	.099

* The employment figures do not include employment in the final demand
sectors including governments, finance, insurance, real estate, and construciton.

TABLE 3.1-D. PROJECTION 1 OF EMPLOYMENT

	1975	1980	1985	1990	1995	2000
Livestock	7165	7165	7165	7165	7165	7165
Irrigated Agriculture	7950	7950	7950	7950	7950	7950
Dryland Agriculture	559	559	559	559	559	559
Food Processing	3402	4291	5438	6583	7252	7616
Mining	1159	1182	1202	1217	1228	1234
Electronics	6684	14548	19565	21654	23970	25659
Paper	133	138	142	145	147	149
Printing	645	755	836	878	917	944
Chemicals and Petroleum	100	136	164	185	199	209
Lumber	431	464	487	497	507	515
Miscellaneous Manufacturing	867	978	1076	1144	1194	1226
Utilities	2531	3020	3424	3663	3862	3997
Services	7540	8263	8830	9249	9539	9728
Trade	14243	14668	15259	15642	15938	16136
Education 1/	17905	18933	19694	20131	20503	20757
Government 1/	9229	11328	12955	13983	14801	15340
Finance, Insurance and 2/ Real Estate	2597	3145	3592	3901	4131	4280
Construction and Ordinance 2/	5508	6670	7617	8272	8760	9075
Commuters Outside Region 3/	18000	20070	22850	26481	31111	37031
Total	106,848	124,263	138,805	149,299	159,733	169,570

1/ Assumes same growth rate as government payments.

2/ Assumes same growth rate as final payments.

3/ Assumes same growth rate as Colorado Division of Planning's employment projections in Region 3.

3.2   PROJECTION 2

The second projection examines the economic growth impacts of exogenous or externally generated growth in the government sector.   That is, in addition to government growth induced by growth in other sectors of the regional economy, this projection assumes that government expenditures increase in and of themselves.   On the one hand, it can be argued that government responds solely to internal growth of the region. This seems particularly true for city and county government. On the other hand, State and federal expenditures may not be related to regional economic activity, as in the case of the installation of new government facilities, such as the U.S. Department of Agriculture Fort Collins Computer Center, or of public programs, such as welfare assistance.

Based upon data for the last 9 years, the Larimer-Weld Regional Council of Governments' staff has estimated that the government sector can be expected to increase at 6.8 percent per annum during the period from 1975 to 1980. This study assumes that after that period, expenditure levels of city, county, State and federal governments will increase at a decreasing rate corresponding with the antici-pated growth in the basic sectors of the regional economy. The growth rates assumed for government expenditures are shown in Table 3.2-A.

Table 3.2-A.   Government Expenditure Growth Rates to the Year 2000

		Time Period		
1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
0.068	0.055	0.040	0.025	0.010

Table 3.2-A shows the results of projecting the Larimer-Weld input-output table assuming the growth rates of Tables 3.1-A and 3.2-A.   Total gross output of the region is projected to increase nearly 92 percent from $8,072,660,000 in 1975 to $15,466,850,000 in 2000.

Employment projections corresponding with Table 3.2-B are shown in Table 3.2-C.   Total employment is projected to increase from 106,848 persons in 1975 to 199,185 persons in 2000.   Note that the number of commuters grows at a slightly higher rate than employment in the region, due to the higher projected growth expectations of Region 3.

TABLE 3.2-B PROJECTION 2 OF TOTAL GROSS OUTPUTS (millions of dollars)

	1975	1980	1985	1990	1995	2000
Livestock	477.64	622.73	780.93	928.47	1013.40	1066.44
Irrigated Agriculture	128.23	154.96	184.06	211.80	228.00	237.54
Dryland Agriculture	17.48	19.96	22.66	25.20	26.81	27.67
Food Processing	809.73	1074.05	1362.47	1650.06	1818.46	1909.89
Mining	36.21	37.43	38.59	39.53	40.22	40.59
Electronics	406.56	860.25	1160.32	1287.76	1427.37	1528.20
Paper	2.70	2.90	3.08	3.22	3.32	3.38
Printing	10.70	13.28	15.37	16.76	17.91	18.59
Chemical and Petroleum	5.11	6.88	8.39	9.49	10.28	10.78
Lumber	11.96	12.97	13.68	14.03	14.37	14.61
Miscellaneous Manufacturing	18.65	22.39	25.73	28.32	30.24	31.31
Utilities	177.42	229.93	274.38	305.89	330.73	345.01
Services	223.81	253.60	281.84	304.81	321.23	330.25
Trade	994.20	1085.75	1169.68	1235.44	1284.99	1311.52
Education	180.86	236.10	292.92	342.65	379.86	397.12
Households	1240.68	1474.87	1686.32	1848.70	1973.71	2040.42
Final Payments	3330.72	4193.09	4942.26	5498.71	5911.00	6153.53
Total Gross Output	8072.66	10301.13	12262.68	13750.83	14831.93	15466.85
Total Government Payments	360.35	480.17	585.17	663.58	723.76	757.20

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TABLE 3.2-C PROJECTION 2 OF EMPLOYMENT

	1975	1980	1985	1990	1995	2000
Livestock	7165	7165	7165	7165	7165	7165
Irrigated Agriculture	7950	7950	7950	7950	7950	7950
Dryland	559	559	559	559	559	559
Food Processing	3402	4296	5450	6600	7274	7640
Mining	1159	1198	1235	1265	1287	1299
Electronics	6884	14624	19725	21892	24265	25979
Paper	133	142	151	158	163	166
Printing	645	797	922	1006	1075	1115
Chemical and Petroleum	100	138	168	189	206	216
Lumber	431	467	492	505	517	526
Miscellaneous Manufacturing	867	1030	1184	1303	1391	1440
Utilities	2531	3219	3841	4282	4630	4830
Services	7540	8622	9582	10364	10922	11228
Trade	14243	15200	16376	17296	17990	18361
Education 1/	17905	23374	28999	33922	37606	39315
Government 1/	9229	12298	14987	16995	18536	19392
Finance, Insurance and Real Estate2/	2597	3269	3853	4287	4608	4797
Construction and Ordinance 2/	5508	6934	8173	9093	9775	10176
Commuters Outside Region3/	18000	20070	22850	26481	31111	37031
Total	106,848	131,352	153,662	171,312	187,030	199,185

1/ Assumes same growth rate as government payments.

2/ Assumes same growth rate as final payments.

3/ Assumes same growth rate as Colorado Division of Planning's employment projections in Region 3.

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Finally, it should be noted that growth in the government sector has a marked effect upon the education sector. This is caused by the fact that nearly one quarter of current government expenditures are on education, as can be seen from Table 2.1. The projection model assumes that this relationship will continue in the future. This assumption requires further explanation in light of recent State government policies.

The State government has recently imposed enrollment limits on the local universities. This policy can be expected to have continuing negative effects on government expenditures on higher education and education employment levels. However, there are several reasons to question the long-term effect of this policy on the education sector projections. First, the education sector is comprised of all levels of education, not just the State supported universities so that reduced higher education expenditures could be partially offset by other education expenditures. Secondly, the universities particularly Colorado State University, are rapidly increasing their dollar volume of contract and grant research,; which is independent of enrollment policies and which is, at least partly, an offsetting response to these policies. This increased research activity generates new jobs. Finally, the universities are turning away larger and larger numbers of qualified students each year. These students and their parents can be expected to represent an increasingly important political force opposing the enrollment restrictions, which could ultimately affect State policy.

To accommodate both sides of the argument, the model compromises by allowing the ratio of government expenditures on education to remain constant, while also holding university enrollment levels to their current size. The sensitivity of the population model to an error on either side is less than 10 percent and is not judged to be a significant problem for these projections.

3.3 PROJECTION 3

The third projection examines the economic growth impacts of growth in the level of exports in sectors other than the basic sectors. That is, in addition to the growth rates estimated for the basic sectors of the regional economy, growth rates estimated for export sales of the other sectors are utilized. The government sector is assumed only to grow in response to regional economic growth.

The growth rates of export sales from the various sectors of
the economy are derived from the OBERS projections for the
State.[6] These projections represent the combined effort of
the U.S. Department of Commerce and the U.S. Department of
Agriculture to provide projections of economic activity for
the country and areas within it. It is assumed that exports
from the various sectors will grow at the rates of increase
projected for those sectors in the State. These growth
rates are shown in Table 3.3-A.

Table 3.3-B shows the results of projecting the Larimer-Weld
input-output table assuming the growth rates of Tables 3.1-A
and 3.3-A. Total gross output of the region is projected to
increase nearly 94 percent from $8,072,660,000 in 1975 to
$15,652,530,000 in 2000. Note that while the amount of
growth in total gross output is nearly the same as the
second projection in Table 3.2-B, the distribution of that
growth among sectors is significantly different.

The employment projections corresponding with Table 3.3-B are
shown in Table 3.3-C. Total employment is projected to
increase from 106,848 persons in 1975 to 190,848 in persons
in 2000. Note that while the third projection shows the
largest increase in total gross output, the second projection
has the largest increase in employment. This is due to the
different distributions of growth among the individual
economic sectors.

3.4   PROJECTION 4

The fourth projection examines the consequences of growth in
all sectors of the economy. It includes the growth rates
previously considered separately or in pairs for the basic
sectors, the government sector, and the remaining sectors.

Table 3.4-A shows the results of projecting the Larimer-Weld
input-output table utilizing the growth rates given in
Tables 3.1-A, 3.2-A, and 3.3-A. Total gross output is
projected to increase nearly 114 percent from $8,072,660,000
in 1975 to $17,238,010,000 in 2000.

Table 3.4-B shows the employment estimates corresponding
with the total gross outputs in Table 3.4-A. Total employment
is projected to increase from 106,848 persons in 1975 to
220,466 persons in the year 2000.

Table 3.3-A. Non-Basic Sector Final Demand Growth Rates to the Year 2000*

	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
Irrigated Agriculture	0.011	0.013	0.013	0.014	0.014
Dryland Agriculture	0.011	0.013	0.013	0.014	0.014
Mining	0.019	0.017	0.017	0.016	0.016
Paper	0.055	0.042	0.042	0.036	0.036
Printing	No exports				
Chemical and Petroleum	No exports				
Lumber	0.046	0.030	0.030	0.028	0.028
Miscellaneous Manufacturing	0.058	0.041	0.041	0.037	0.037
Utilities	No exports				
Services	0.064	0.046	0.046	0.044	0.044
Trade	0.051	0.033	0.033	0.033	0.033

*Derived from OBERS projections.

TABLE 3.3-B   PROJECTION 3 OF TOTAL GROSS OUTPUTS

	1975	1980	1985	1990	1995	2000
Livestock	477.64	622.48	780.10	927.31	1012.37	1066.24
Irrigated Agriculture	128.23	156.17	186.44	215.56	233.52	245.35
Dryland Agriculture	17.48	19.55	21.78	23.96	25.46	26.61
Food Processing	809.73	1074.24	1362.35	1649.96	1818.94	1911.79
Mining	36.21	40.24	44.48	48.94	53.68	58.77
Electronics	406.56	855.86	1151.09	1274.09	1410.46	1509.97
Paper	2.70	3.28	3.77	4.31	4.94	5.68
Printing	10.70	13.54	15.61	17.17	18.79	20.38
Chemical and Petroleum	5.11	6.93	8.49	9.66	10.56	11.22
Lumber	11.96	14.11	15.63	16.94	18.44	20.04
Miscellaneous Manufacturing	18.65	22.53	25.71	28.44	31.03	33.52
Utilities	177.42	224.02	259.75	285.06	308.36	328.62
Services	223.81	273.17	319.35	368.45	415.13	466.50
Trade	994.20	1179.26	1319.69	1461.11	1613.87	1780.62
Education	180.86	193.51	203.13	209.84	216.13	221.68
Households	1240.68	1408.01	1537.40	1631.58	1718.63	1795.80
Final Payments	3330.72	4165.12	4844.76	5364.03	5796.73	6149.75
Total Gross Output	8072.66	10272.01	12099.55	13536.41	14707.04	15652.53
Total Government Payments	360.35	452.19	523.94	573.86	616.64	650.38

TABLE 3.3-C   PROJECTION 3 OF EMPLOYMENT

	1975	1980	1985	1990	1995	2000
Livestock	7165	7165	7165	7165	7165	7165
Irrigated Agriculture	7950	7950	7950	7950	7950	7950
Dryland Agriculture	559	559	559	559	559	559
Food Processing	3402	4297	5449	6600	7276	7647
Mining	1159	1288	1423	1566	1718	1881
Electronics	6884	14550	19568	21659	23978	25669
Paper	133	161	185	211	242	278
Printing	645	812	937	1030	1127	1223
Chemical and Petroleum	100	139	170	193	211	224
Lumber	431	508	563	610	664	721
Miscellaneous Manufacturing	867	1036	1183	1308	1427	1542
Utilities	2531	3136	3636	3991	4317	4601
Services	7540	9288	10858	12527	14114	15861
Trade	14243	16510	18476	20456	22594	24929
Education [1]	17905	19157	20110	20774	21397	21946
Government [1]	9229	11581	13418	14696	15792	16656
Finance, Insurance and Real Estate [2]	2597	3248	3778	4183	4520	4795
Construction and Ordinance [2]	5508	6888	8012	8871	9586	10170
Commuters Outside Region [3]	18000	20070	22850	26481	31111	37031
Total	106,848	128,348	146,290	160,830	175,748	190,848

[1] Assumes same growth rate as government payments.

[2] Assumes same growth rate as final payments.

[3] Assumes same growth rate as Colorado Division of Planning's employment projections in Region 3.

TABLE 3.4-A PROJECTION 4 OF TOTAL GROSS OUTPUTS

	1975	1980	1985	1990	1995	2000
Livestock	477.64	623.77	782.79	931.30	1017.31	1071.61
Irrigated Agriculture	128.23	157.08	188.35	218.39	237.03	249.16
Dryland Agriculture	17.48	20.43	23.62	26.68	28.83	30.27
Food Processing	809.73	1075.62	1365.26	1654.27	1824.28	1917.59
Mining	36.21	40.72	45.49	50.44	55.55	60.79
Electronics	406.56	860.37	1160.54	1288.10	1427.83	1528.82
Paper	2.70	3.36	3.94	4.56	5.25	6.02
Printing	10.70	14.22	17.05	19.29	21.43	23.24
Chemical and Petroleum	5.11	7.02	8.66	9.91	10.87	11.57
Lumber	11.96	14.18	15.78	17.17	18.72	20.34
Miscellaneous Manufacturing	18.65	23.65	28.05	31.90	35.33	38.18
Utilities	177.42	238.27	289.59	329.28	363.20	388.12
Services	223.81	283.73	341.48	401.24	455.80	510.63
Trade	994.20	1217.31	1399.41	1579.27	1760.39	1939.60
Education	180.86	238.38	297.12	349.15	388.89	409.12
Households	1240.68	1508.59	1748.14	1943.93	2105.96	2216.06
Final Payments	3330.72	4324.81	5179.31	5859.90	6411.62	6816.90
Total Gross Output	8072.66	10651.49	12894.58	14714.77	16168.29	17238.01
Total Government Payments	360.35	490.07	603.30	691.48	762.50	808.63

TABLE 3.4-B PROJECTION 4 OF EMPLOYMENT

	1975	1980	1985	1990	1995	2000
Livestock	7165	7165	7165	7165	7165	7165
Irrigated Agriculture	7950	7950	7950	7950	7950	7950
Dryland Agriculture	559	559	559	559	559	559
Food Processing	3402	4302	5461	6617	7297	7670
Mining	1159	1303	1456	1614	1778	1945
Electronics	6884	14626	19729	21898	24273	25990
Paper	133	165	193	223	257	295
Printing	645	853	1023	1157	1286	1394
Chemical and Petroleum	100	140	173	198	217	231
Lumber	431	510	568	618	674	732
Miscellaneous Manufacturing	867	1088	1290	1467	1625	1756
Utilities	2531	3336	4054	4610	5085	5434
Services	7540	9647	11610	13642	15497	17361
Trade	14243	17042	19592	22110	24645	27154
Education [1]	17905	23600	29415	34566	38500	40503
Government [1]	9229	12551	15451	17709	19528	20709
Finance, Insurance and Real Estate [2]	2597	3372	4038	4569	4999	5315
Construction and Ordinance [2]	5508	7152	8565	9690	10602	11272
Commuters Outside Region [3]	18000	20070	22850	26481	31111	37031
Total	106,848	135,431	161,142	182,843	203,048	220,466

[1] Assumes same growth rate as government payments.

[2] Assumes same growth rate as final payments.

[3] Assumes same growth rate as Colorado Division of Planning's employment projections in Region 3.

4.0 POPULATION PROJECTIONS

The discussion of population projections is divided into two
parts. First, the data inputs which were used in the population
model are presented. This data was obtained from the Colorado
Division of Planning. Second, the population projections
generated by incorporating the economic projections of the
Larimer-Weld input-output model in the State's population
model are presented.

4.1 INPUT DATA

Data presented are supplied by the Colorado Division of Planning.
For the most part, they are representative of the 1960 to
1970 time period. However, some judgmental adjustments were
made to reflect more recent trends of the 1970's.

Table 4.1-A shows the estimated resident population of
Region 2 as of July 1, 1975. The population is divided by
age and sex groups. The college population is not included
in this total.

Table 4.1-A. Resident Population Distribution, July 1, 1975.

Age Group	Male	Female	Total
0-4	8,343	7,972	16,315
5-9	8,103	7,643	15,746
10-14	8,237	7,764	16,001
15-19	6,939	7,173	14,112
20-24	5,250	5,681	10,931
25-29	8,771	8,174	16,945
30-34	9,701	8,541	18,242
35-39	8,901	6,749	15,650
40-44	8,088	5,483	13,571
45-49	7,499	5,072	12,571
50-54	6,513	4,885	11,398
55-59	5,390	4,510	9,900
60-64	4,303	4,027	8,330
65-69	3,043	3,240	6,283
70-74	2,099	2,566	4,665
75-79	1,463	1,998	3,461
80-84	916	1,318	2,234
85+	900	1,344	2,244
Total	104,459	94,140	198,599

SOURCE: Colorado Division of Planning, 1977.

Table 4.1-B contains the labor participation rates used to calculate the available labor force. The non-college rates are based upon 1970 census data, while the college student rates were developed by the State. Multiple job holdings are assumed to exist among 5 percent of the labor force. The unemployment rate is held constant at 2.9 percent.

Table 4.1-C displays the survival rates assumed for each sex and age group. These are used to calculate the number of deaths during each time period. Table 4.1-D shows the fertility rates assumed for different age groups in order to calculate births. It is assumed that 51 percent of births are male.

Table 4.1-B. Labor Participation Rates

Age Group	Non-College		College	
	Male	Female	Male	Female
0-4	.000	.000	.000	.000
5-9	.000	.000	.000	.000
10-14	.033	.018	.000	.000
15-19	.415	.303	.138	.101
20-24	.742	.532	.247	.177
25-29	.918	.440	.306	.147
30-34	.918	.440	.306	.147
35-39	.933	.498	.311	.166
40-44	.933	.498	.311	.166
45-49	.913	.517	.000	.000
50-54	.913	.517	.000	.000
55-59	.860	.470	.000	.000
60-64	.730	.358	.000	.000
65-69	.387	.161	.000	.000
70-74	.160	.056	.000	.000
75-79	.160	.056	.000	.000
80-84	.160	.056	.000	.000
85+	.160	.056	.000	.000

SOURCE: Colorado Division of Planning, 1977.

Table 4.1-E shows the estimated net annual retirement migration distribution. These estimates are based upon the 1960 and 1970 time period and assume that only persons 60 years or older migrate for retirement. Finally, it is assumed that 230 persons annually migrate to this region for retirement.

The number of migrants calculated according to the employment projections of the input-output model are distributed into sex and age groups according to Table 4.1-F. These distributions are based upon estimated migrant distributions for the 1960 to 1970 time period.

Table 4.1-C. Survival Rates

Age Group	Males	Females
Birth	.98480	.98855
0-4	.99775	.99818
5-9	.99853	.99902
10-14	.99681	.99853
15-19	.99401	.99791
20-24	.99382	.99773
25-29	.99426	.99722
30-34	.99266	.99590
35-39	.98875	.99351
40-44	.98177	.98980
45-49	.96982	.98430
50-54	.95196	.97692
55-59	.92584	.97692
60-64	.89102	.94699
65-69	.84239	.91527
70-74	.78106	.86455
75-79	.70540	.78440
80-84	.53286	.56649
85+	.41867	.43136

SOURCE: Colorado Division of Planning, 1977.

Table 4.1-F. Employment Migration Distribution

Age Group	In-Migration		Out-Migration	
	Male	Female	Male	Female
0-4	.007	.003	.004	.001
5-9	.007	.003	.020	.005
10-14	.007	.003	.040	.010
15-19	.014	.006	.080	.020
20-24	.020	.010	.100	.050
25-29	.150	.130	.120	.060
30-34	.100	.080	.080	.040
35-39	.090	.030	.080	.040
40-44	.080	.020	.075	.025
45-49	.070	.020	.035	.015
50-54	.050	.020	.035	.010
55-59	.035	.015	.020	.009
60-64	.020	.010	.011	.000

SOURCE: Colorado Division of Planning

Table 4.1-G displays the distribution by sex and age of the
college population. The college population is assumed to
remain constant at the 1974 total of 30,000 students, representing
the long-run growth plans developed by the State for the
major higher education institutions in the region.

The military population is assumed to be zero. Also, no
exploration or migrant construction worker populations are
considered.

Table 4.1-G. College Population Distribution

Age Group	Male	Female
0-4	.000	.000
5-9	.000	.000
10-14	.000	.000
15-19	.190	.155
20-24	.250	.250
25-29	.030	.065
30-34	.015	.015
35-39	.010	.010
40-44	.005	.005
45-49	.000	.000
50-54	.000	.000
55-59	.000	.000
60-64	.000	.000
65-69	.000	.000
70-74	.000	.000
75-79	.000	.000
80-84	.000	.000
85+	.000	.000

SOURCE: Colorado State Division of Planning, 1977.

4.2 PROJECTION RESULTS

Four population projections were calculated on the basis of
the four economic projections. Each of the projections
utilizes the same population characteristics data which are
presented above. The population projections differ with
respect to the economic assumptions utilized to calculate
the net migration component of the total population size.

4.2.1 Population Projection 1

The first population projection utilizes the economic conditions
of the first economic projection. Economic projection 1
assumes growth occurs only in response to growth in three
basic sectors of the regional economy. These economic
growth assumptions are summarized in Table 4.2.1-A.

Table 4.2.1-A. Economic Growth Assumptions for Population Projection 1.

Sector	Time Period				
	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
Livestock	0.020	0.020	-0.020	-0.020	0.020
Food Processing	0.060	0.050	0.040	0.020	0.010
Electronics	0.170	0.063	0.021	0.021	0.014

All other sectors as induced by growth in above specified sectors.

Population projection 1 is shown in Table 4.2.1-B. Population is projected to grow from 228,599 in 1975 to 371,408 in 2000. Initially, employment in-migration represents the largest contribution to total population, but as the base population increases and employment level increases decline, births become the largest contributor to population growth. On the other hand, as the rate of increase to the population decreases, the relative share of the population between the ages of 0 and 24 years decreases from 43 percent in 1975 to 36 percent in 2000. This is also reflected in the school age population which decreases from 22 percent of the population in 1975 to 19 percent in 2000.

4.2.2 Population Projection 2

Population projection 2 is based upon economic projection 2, which includes exogenous growth in the government section. The economic growth assumptions utilized are shown in Table 4.2.2-A.

TABLE 4.2.1-B PROJECTION 1 OF POPULATION, 1975-2000

	1975	1980	1985	1990	1995	2000
Population	228,599	271,343	300,607	324,911	348,648	371,408
Net Change	42,744	29,265	24,304	23,737	22,760	
Births	19,157	21,547	21,974	23,632	23,598	
Deaths	8,209	9,684	11,347	13,249	15,365	
Employment Migration	30,646	16,251	12,527	13,473	13,378	
Age 0-24	98,455	108,725	116,144	121,657	127,983	134,857
Age 25-64	111,257	139,942	157,089	170,457	182,050	191,792
Age 65+	18,887	22,676	27,374	32,797	38,614	44,760
Employment	106,848	124,263	138,805	149,299	159,733	169,570
Net Change	17,415	14,542	10,494	10,434	9,837	
School Age Population	51,317	54,160	57,395	62,767	67,511	70,031
Age 5-11	22,146	23,001	26,022	29,276	30,540	31,087
Age 12-14	9,601	9,620	10,038	11,659	12,967	13,201
Age 15-18	19,570	21,540	21,335	21,832	24,004	25,742

Table 4.2.2.-A. Economic Growth Assumptions for Population Projection 2

Sector	Time Period				
	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
Livestock	0.020	0.020	-0.020	-0.020	0.020
Food Processing	0.060	0.050	0.040	0.020	0.010
Electronics	0.170	0.063	0.021	0.021	0.014
Government	0.068	0.055	0.040	0.025	0.010

All other sectors as induced by growth in above specified sectors.

The second population projection is presented in Table 4.2.2-B. Population is projected to grow from 228,599 in 1975 to 421,481 in 2000. Employment migration is the most important factor in population growth through the year 1985, whereas it was only the largest contributor in projection 1 through 1980. This is caused by the larger anticipated growth in employment, resulting from expansion of the government sector and induced growth to other sectors.

Projections 1 and 2 differ only slightly in terms of the age distribution of the population over time.

4.2.3 Population Projection 3

The third population projection assumes growth in exports of most of the sectors. This projection is the result of economic projection 3. The economic growth assumptions utilized are summarized in Table 4.2.3-A.

TABLE 4.2.2-B PROJECTION 2 OF POPULATION, 1975-2000

	1975	1980	1985	1990	1995	2000
Population	228,599	281,587	323,184	359,706	393,291	421,481
Net Change	52,988	41,597	36,522	33,585	28,190	
Births	19,821	23,301	24,315	24,842	25,963	
Deaths	8,299	9,956	11,873	14,107	16,633	
Employment Migration	40,316	27,102	22,930	21,700	17,710	
Age 0-24	98,455	110,153	119,876	128,006	136,801	145,680
Age 25-64	111,257	148,759	175,682	198,003	215,848	227,414
Age 65+	18,887	22,676	27,626	33,697	40,642	48,388
Employment	106,848	131,352	153,662	171,312	187,030	199,185
Net Change	24,504	22,310	17,650	15,718	12,155	
School Age Population	51,317	54,508	58,709	65,997	72,919	76,809
Age 5-11	22,146	23,136	26,963	31,599	33,839	34,667
Age 12-14	9,601	9,678	10,161	12,236	14,178	14,720
Age 15-18	19,570	21,694	21,585	22,162	24,903	27,422

Table 4.2.3-A. Economic Growth Assumptions for Population Projection 3

Sector	Time Period				
	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
Livestock	0.020	0.020	-0.020	-0.020	0.020
Food Processing	0.060	0.050	0.040	0.020	0.010
Electronics	0.170	0.063	0.021	0.021	0.014
Government	As induced by other growth				
Irrigated Agriculture	0.011	0.013	0.013	0.014	0.014
Dryland Agriculture	0.011	0.013	0.013	0.014	0.014
Mining	0.014	0.017	0.017	0.016	0.016
Paper	0.055	0.042	0.042	0.036	0.036
Printing	No exports				
Chemical & Petroleum	No exports				
Lumber	0.046	0.030	0.030	0.028	0.028
Miscellaneous Manufacturing	0.058	0.041	0.041	0.037	0.037
Utilities	No exports				
Services	0.064	0.046	0.046	0.044	0.044
Trade	0.051	0.033	0.033	0.033	0.033
Education	As induced by other growth				

Population projection 3 is given in Table 4.2.3-B. The
population is shown to grow from 228,599 in 1975 to 406,231
in 2000. Employment migration exceeds births over the first
five-year period, and the age distribution gradually shifts
to the upper age groups as was the case in projection 1.

4.2.4 Population Projection 4

The fourth population projection examines the consequences
of growth in the basic sectors, the government sector, and
the remaining sectors. It represents the culmination of the
building process of economic projections 1, 2, and 3.
Projection 4 of population corresponds with the fourth
economic projection, the growth assumptions of which are
summarized in Table 4.2.4-A.

Projection 4 of population is shown in Table 4.2.4-B. The
population is projected to grow from 228,599 in 1975 to
456,309 in 2000. Employment migration is the largest con-
tributor to population growth through 1995. The proportion

TABLE 4.2.3-B PROJECTION 3 OF POPULATION, 1975-2000

	1975	1980	1985
Population	228,599	277,246	312,062
Net Change	48,647	34,816	31,064
Births	19,540	22,457	23,160
Deaths	8,261	9,827	11,623
Employment Migration	36,218	21,036	18,377
Age 0-24	98,455	109,548	118,077
Age 24-64	111,257	145,022	166,465
Age 65+	18,887	22,676	27,520
Employment	106,848	128,348	146,290
Net Change	21,500	17,942	14,540
School Age Population	51,317	54,361	58,100
Age 5-11	22,146	23,079	26,544
Age 12-14	9,601	9,653	10,100
Age 15-18	19,570	21,629	21,456

	1990	1995	2000
Population	343,126	374,504	406,231
Net Change	31,378	31,726	
Births	23,832	25,478	
Deaths	13,722	16,125	
Employment Migration	20,119	21,224	
Age 0-24	124,971	132,946	141,873
Age 24-64	184,877	201,873	217,629
Age 65+	33,278	39,685	46,729
Employment	160,830	175,748	190,848
Net Change	14,918	15,100	
School Age Population	64,483	70,406	73,968
Age 5-11	30,493	32,260	33,227
Age 12-14	11,982	13,607	14,023
Age 15-18	22,008	24,539	26,719

of the population over 25 years old is projected to increase
from 58 percent in 1975 to 67 percent in 2000.

Finally, it can be seen from projections 1, 2, and 3 that
growth of the three basic sectors accounts for 142,809
persons or 63 percent of the growth to the year 2000.
Government growth accounts for 50,073 persons or 22 percent
and the OBERS estimates of growth in the remaining sectors
accounts for approximately 34,823 persons or 15 percent of
the projected growth to the year 2000.

Table 4.2.4-A. Economic Growth Assumptions for Population Projection 4

Sector	Time Period				
	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
Livestock	0.020	0.020	-0.020	-0.020	0.020
Food Processing	0.060	0.050	0.040	0.020	0.010
Electronics	0.170	0.063	0.021	0.021	0.014
Government	0.068	0.055	0.040	0.025	0.010
Irrigated Agriculture	0.011	0.013	0.013	0.014	0.014
Dryland Agriculture	0.011	0.013	0.013	0.014	0.014
Mining	0.019	0.017	0.017	0.016	0.016
Paper	0.055	0.042	0.042	0.036	0.036
Printing	No exports				
Chemical & Petroleum	No exports				
Lumber	0.046	0.030	0.030	0.028	0.028
Miscellaneous Manufacturing	0.058	0.041	0.041	0.037	0.037
Utilities	No exports				
Services	0.064	0.046	0.046	0.044	0.044
Trade	0.051	0.033	0.033	0.033	0.033
Education	As induced by other growth				

TABLE 4.2.4-B PROJECTION 4 OF POPULATION, 1975-2000

	1975	1980	1985
Population	228,599	287,481	334,630
Net Change	58,882	47,149	43,290
Births	20,203	24,210	25,502
Deaths	8,351	10,099	12,149
Employment Migration	45,880	31,888	28,787
Age 0-24	98,455	110,974	121,808
Age 25-64	111,257	153,832	185,051
Age 65+	18,887	22,676	27,771
Employment	106,848	135,431	161,142
Net Change	28,583	25,711	21,701
School Age Population	51,317	54,708	59,413
Age 5-11	22,146	23,214	27,484
Age 12-14	9,601	9,711	10,223
Age 15-18	19,570	21,783	21,706

	1990	1995	2000
Population	377,920	419,152	456,309
Net Change	41,232	37,157	
Births	26,312	27,843	
Deaths	14,580	17,393	
Employment Migration	28,350	25,557	
Age 0-24	131,319	141,764	152,696
Age 25-64	212,423	235,675	253,256
Age 65+	34,177	41,713	50,356
Employment	182,843	203,048	220,466
Net Change	20,205	17,418	
School Age Population	67,712	75,814	80,747
Age 5-11	32,815	35,558	36,807
Age 12-14	12,559	14,818	15,542
Age 15-18	22,338	25,438	28,398

5.0 ASSESSMENT OF PROJECTIONS

Two sets of projections have been generated: economic pro-
jections of both dollar values of production and employment
and projections of population size. The projections are
interdependent, since the population projections are largely
a function of the economic projections. The assessment of
these projections, therefore, logically examines the economic
projections first and the population projections second.

5.1 ASSESSMENT OF ECONOMIC PROJECTIONS

The economic projections were generated by projecting the
Larimer-Weld input-output table for 1974. The input-output
table represents the structural interdependence of the
economy; it describes the supply and demand conditions of
the economy. Projecting the input-output table produces
consistent projections in that the production of each industry
must balance with the demands for its products.

In assessing the reliability of these projections, there are
three major problems which must be considered: structural
changes, errors of estimation of final demand, and entry of
new industries into the region. That is, problems arise in
the projection process if the structure of the regional
economy changes from that described in the initial input-
output table, if the final demand estimates utilized to
drive the model are incorrect, or if new industries expand
the regional economy.

The structural coefficients of the regional economy are
likely to change over time. There are four main reasons why
the interrelationships of the economy might change: relative
price changes, product-mix variations, technical change and
economics of scale. Relative price changes affect the
coefficients via the substitution of one input for another.
Inputs whose relative prices are falling tend to be sub-
stituted for those with rising relative prices, and, therefore,
alter the input mix.

The product or output mix of various sectors may also change
over time. An obvious reason for this change is that market
conditions may change as a function of consumer demand
changes. Over time, individual firms will adjust their
output according to the demand for their present and possible
products. Since the input-output model aggregates firms
into sectors, another reason for changes in product mix of a
sector over time is that the different firms within the
sector may grow at different rates.

Technical changes involve revolutionizing the current products and/or the process by which they are produced. Technological advances have historically altered the nature of the products produced as well as the methods of their production. Unless science is expected to stand still, technological innovations will certainly change the structural coefficients of the regional economy over time. Such innovations, however, are extremely difficult to forecast.

Economics of scale are primarily important in the early stages of an industry's growth when its production process is rapidly changing in response to increasing volumes of output. They are also important in the case of the agglomeration (clustering) of similar or complementary firms, which may also alter production processes and, thus, the structural coefficients of the model.

The importance of these four causes of changes in the structural coefficients of the regional economy is directly related to time. The longer the time period being examined, the more likely one or more of these four effects will alter the model. The question, then, is how long does it take for such changes to occur?

In general, the changes being discussed occur relatively slowly. While relative price changes can be expected to alter input mixes, investments in machinery, labor unions and contracts, and contracts for raw materials will tend to dampen and slow such changes. Product mixes may change, but this is more likely to be due to new firms (a problem to be discussed below), than to rapid changes in existing firms. Technical changes tend to be slow because they require not only time for the innovation to diffuse through the system, but also the replacement of existing capital. Finally, changes due to economics of scale occur only as rapidly as these scale economics are achieved, and this is not very rapidly. Specifically, structural changes are not seen to represent a significant problem during the first five-year time period, and probably, not the first ten years. Beyond five to ten years, it is possible for structural changes to occur which could significantly affect the projections. The prudent planner will allow for this possibility by periodically updating the projections and avoiding irreversible decisions based upon projections far in the future.

The second possible source of error in the economic projections concerns the final demand growth estimates utilized to drive the model. The largest possible source of this error is in the growth estimates of the basic sectors. For example, in the fourth projection, which assumes growth in all sectors,

the three basic sectors account for 63 percent of the growth to the year 2000 and the three basic sectors plus government account for 81 percent. The sensitivity of the projections to errors in the final demand growth rates, however, is not great, as demonstrated in the Larimer-Weld input-output study.7 While periodic verification of the final demand growth estimates is obviously wise, errors of even 20 percent in these estimates are tolerable for general, long-range planning.

Thirdly, long-term consistent projections might be thrown off to some extent by the appearance of one or more new industries during the projection period. Obviously, a projection of the regional economy to the year 1975 that was constructed in 1960 would have failed to pick up the effects of the rapid growth of the electronics industry in this region. Needless to say, such unexpected developments affect all types of forecasting. What is required is that when some new form of economic activity appears, earlier projections should be adjusted to take into account its effects. It does not seem likely that the present projections will be affected by such new economic activities during at least the first five years, but subsequently there is always the possibility of such occurrences and the need for updating the projections to reflect them.

Finally, the four projections represent the progressive development towards a holistic projection, not necessarily a range of possible futures. As such, the fourth economic projection is intended to be the most realistic. The first three projections represent steps in the development of the fourth projection, and are reported only for the purpose of showing the contributions of different components of the total projection. Projection 4 predicts future regional growth to occur as a function of both internal and external economic forces. These forces are expected among all of the sectors of the regional economy, though not in equal shares.

Moreover, Projection 4 differs radically from the Colorado Division of Planning's projections for this region.8 Both projection 4 of employment and the State's high series employment projection are graphed in Figure 5.1-A. While the estimates are essentially the same for 1975, they diverge rapidly. The initial divergence is due to the failure of the State's model to account for the extremely rapid expansion of the electronics sector during the 1970's. This is caused by the State's reliance on national statistics, rather than on local conditions for generating its projections. The rapid growth of this basic sector of the economy serves to provide the base which maintains the divergence of the two projections through the year 2000.
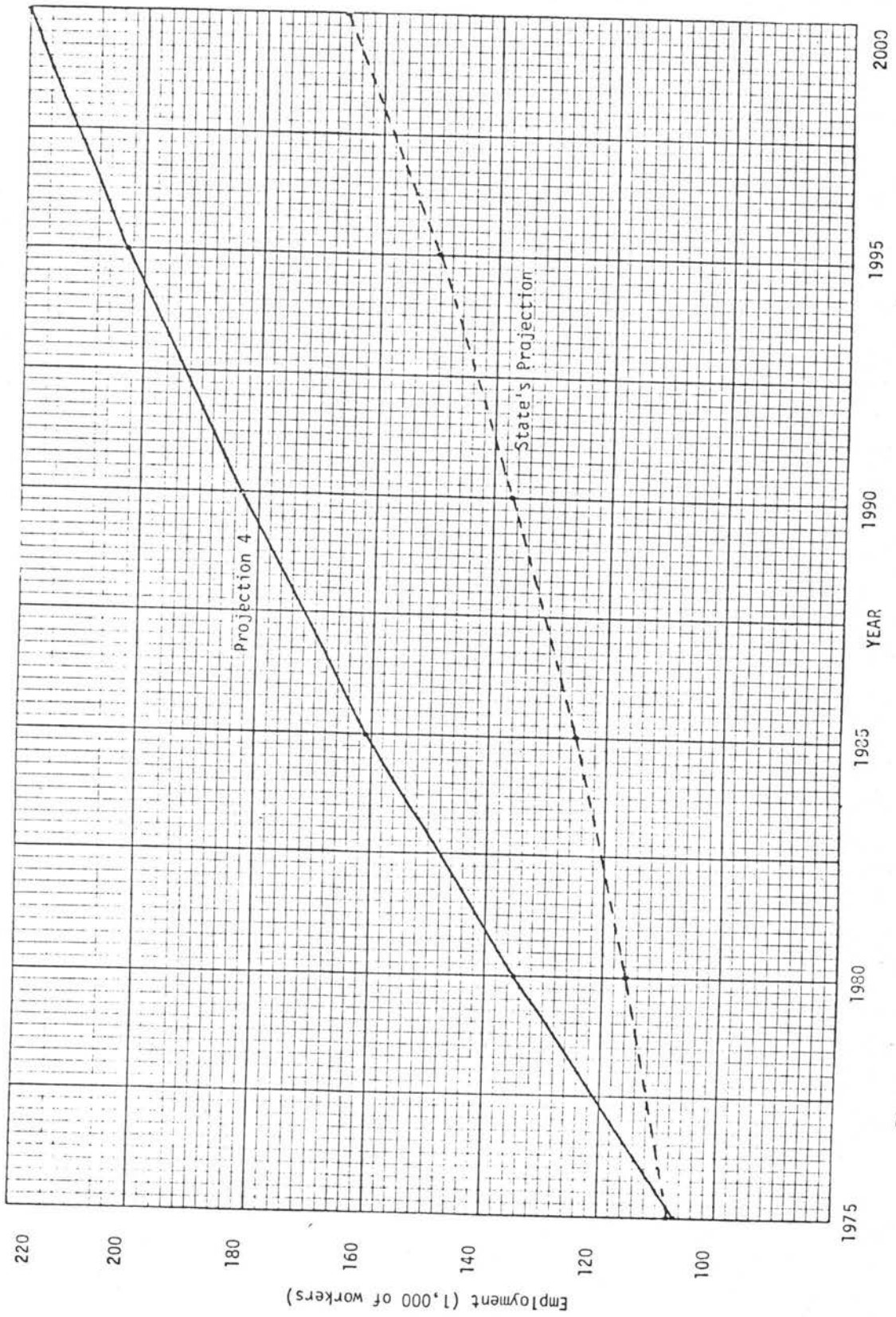
Figure 5.1-A. Comparison of Employment Projection 4 and the State's Employment Projection

A more fundamental and important difference between the projections is that projection 4 shows declining rates of growth, while the State's projection is one of exponential growth. That is, projection 4 shows employment growing at a decreasing rate while the State's projection shows it growing at an increasing rate. Ultimately, the State's projection must exceed projection 4. Beyond the year 2000, the difference between projection 4 and the State's projection will decrease, until they eventually cross with the State's projection becoming the largest. Projection 4 embodies the realization of the major basic sector firms that natural limits exist on growth and that the regional economy must eventually converge with a slower, sustainable rate of growth. The State's projection shows the regional economy growing at faster and faster rates with no concern for natural resource, environmental or economic limits.

5.2 ASSESSMENT OF POPULATION PROJECTIONS

The population projections were calculated utilizing the employment projections of the Larimer-Weld input-output model and the birth, death, and migration projections of the State's population model. The reliability of the population projections depends upon: the input data to the population model, the employment projections, and policies affecting migration.

The input data to the population model was derived from historical data by the Colorado Division of Planning. Typically, the data are indicative of the 1960 to 1970 time period, though some judgmental adjustments were made by the State to reflect changing trends in the 1970's.[9]

Without a primary data collection effort, the State's input data estimates are the best available. A number of the input estimates, such as the number of commuters outside the region, were checked against U.S. Bureau of Census data and were found to be in general agreement. Moreover, the sensitivity of population projections does not seem to be as great for errors in this data as for errors in the employment data, since population growth in this region is largely due to in-migration.

The employment estimates are calculated from the results of projecting the input-output model on the basis of constant employment/dollar value of output ratios. This is a potential source of error, since future conditions may alter these relations. In the past, technology has served to make industry more capital and less labor intensive, thus reducing the employment/ output ratio. On the other hand, future

energy shortages could serve to reverse this trend and increase the employment/ output ratio. In the short run, such changes should not significantly affect the employment projections, but long-run projections should be periodically revised to reflect changing employment/output ratios.

Thirdly, the population projections may be affected by changing governmental policies, including state and local land use policies; air and water pollution control requirements; growth management strategies and limits on available natural resources such as water. These and other future governmental policies have the potential for altering industrial and residential location decisions, and, thus, the population of the two county region. Again, while short-term projections will not be affected, long-term population projections must be periodically updated to reflect such changing policies.

Finally, as was the case for the economic projections, population projection 4 represents the culmination of the preceding projections. The first three population projections are the building blocks of the fourth and most complete projection; they demonstrate the process of constructing the final projection as well as illustrate the comparative contributions of its components. The four projections are graphed in Figure 5.2-A.

Also, as was the case for the economic projections, population projection 4 differs radically from the Colorado Division of Planning's projections. Projection 4 of population and the State's high series population projection are graphed in Figure 5.2-B and can be seen to differ much as the employment projections differ. In fact, the divergence of the population projections is caused by the difference between the economic projections.

The fundamental difference between the projections of this study and the Colorado Division of Planning's projections identified in the economic projections is also present in the population projections. As shown in Figure 5.2-B, projection 4 predicted declining rates of growth whereas the State's projection is one of exponential growth. That is, projection 4 indicates an eventual leveling-off of growth as the region becomes increasingly developed; the State's projection indicates faster and faster growth as the region becomes more developed. There are obviously limits to growth, but these are only recognized in projection 4. Moreover, this projection's recognition of limits is a direct function of the limits recognized by the basic industry firms who provided their own growth plans.
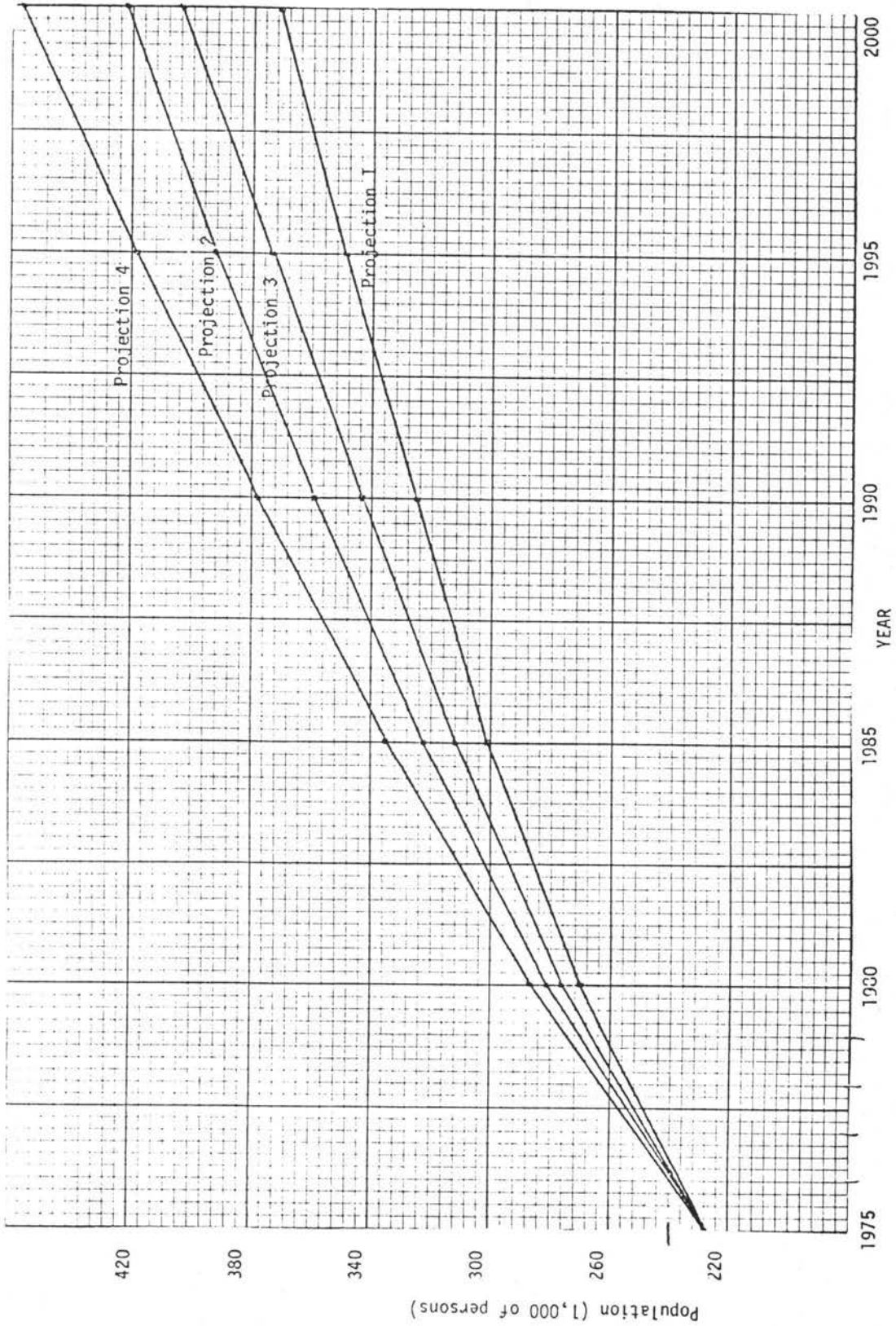
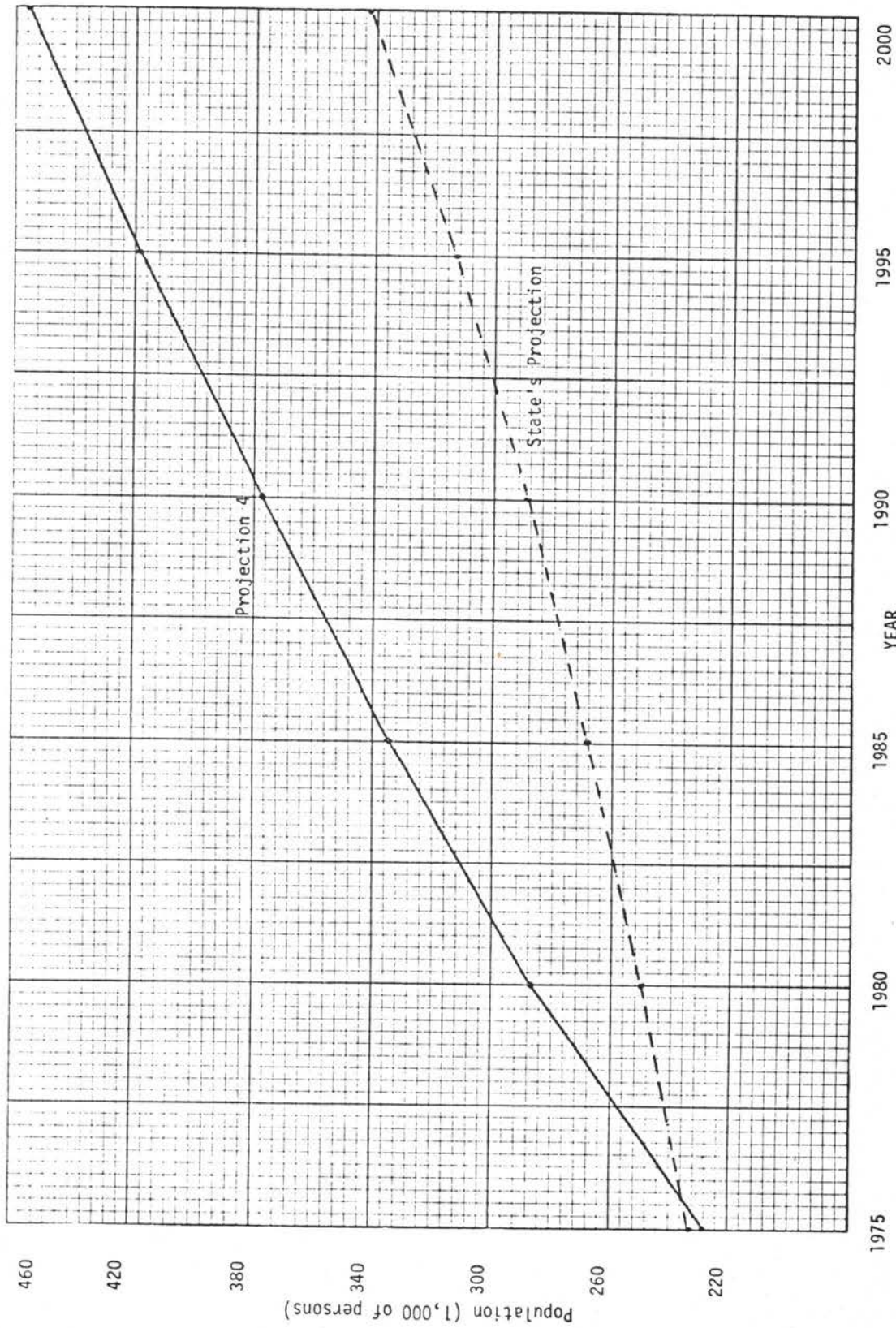Figure 5.2-A Contributions of Population Projections

Figure   Comparison of Population Projection 4 and the State's Population Projection
5.2-B

While projection 4 is considerably greater than the State's projection, it may, in fact, be quite conservative. The population of the region is estimated to have grown from 125,687 in 1960 to 228,599 in 1975. This represents a compound growth rate of 4.1 percent. If this growth rate is extrapolated to the year 2000, as is often done, the population is projected to grow to 624,227, or 37 percent more than projection 4. Moreover, projection 4 does not account for new industries locating in this region, and thus, stimulating yet more growth. Projection 4 simply projects what is known about the economic plans for the region.

6.0 CONCLUSIONS

Input-output analysis represents the best method of projecting regional economic growth, because it generates consistent projections. That is, unlike other projection techniques, input-output projections require that the economic system balances, that the projections of one sector be in agreement with the projections of all other sectors.

Projection 4 of output, employment and population represents the combined effects of economic growth in the various sectors of the regional economy. These projections, however, are conservative in that they do not speculate on the effects of possible new industries locating in the region. Such environmental attributes as clean water and air, open space, and the mountains are conducive to attracting new firms. Interstate highway 25 provides ready access to major shipping lines. Moreover, many local communities actively seek to attract new firms to their cities. Therefore, it seems highly likely that population, for example, will exceed the projection 4 estimate of 456,309 by the year 2000. A year 2000 population of at least 500,000 is highly probable.

Finally, it must be reiterated that the reliability of the projections is directly related to the length of the projection period. The greater the length of the projection period, the greater is the chance that the structure of the regional economy will change and, thus, throw off the projections. Short-term projections of five to ten years are highly likely to be correct, while long-term projections should be updated periodically to reflect changing conditions.

The consistent and detailed projections of the input-output model provide useful information to planners for a variety of purposes. It is necessary, however, to remember that the greatest reliance should be placed on the near future projections and that the prudent planner will avoid irreversible

decisions based upon extremely long-range projections. The
long-range projections provide a basis for formulating
general plans, but should always be updated prior to making
final decisions.

ENDNOTES

[1] U.S. Bureau of Census, Estimates of the Population of Colorado Counties and Metropolitan Areas, July 1, 1974 and 1975, Current Population Report Series P-26, No. 75-6, U.S. Government Printing Office, Washington, D.C., 1976.

[2] A detailed evaluation of the CPE II model is contained in Review of the CPE II Model prepared by Parsons, Brinkerhoff, Quade, and Douglas, Inc. for the Larimer-Weld Regional Council of Governments, February, 1976.

[3] S.L. Gray, P.C. Huszar, and J.R. McKean, Interindustry Analysis and Economic Profile of the Larimer-Weld Region, (Loveland, Colorado: Larimer-Weld Regional Council of Governments, December 6, 1976).

[4] See, for example, W.H. Miernyk, The Elements of Input-Output Analysis (New York: Random House, Inc., 1965), and H.W. Richardson, Input-Output and Regional Economics (London: Redwood Press, Limited, 1972).

[5] S.L. Gray and J.R. McKean, An Economic Analysis of Water Use in Boulder, Larimer and Weld Counties, Colorado, With Projections to 1980, Experiment Station Bulletin, General Series 953, Colorado State University, Fort Collins, Colorado, April, 1976.

[6] U.S. Water Resources Council, OBERS Projections, Economic Activity in the U.S., Vol. 4, States, (Washington, D.C.: U.S. Government Printing Office, 1972).

[7] S.L. Gray, et. al., op. cit.

[8] D.E. Monarchi, Colorado Regional Population Projections - 1970 to 2000, Vol. 2, Planning Region 2, Larimer-Weld. Prepared for the Colorado Division of Planning (Boulder, Colorado: Business Research Division, Graduate School of Business Administration, University of Colorado, July, 1975).

[9] D.E. Monarchi, op. cit.

[10] Parsons, et. al., op. cit.

[11] U.S. Bureau of Census, op. cit.