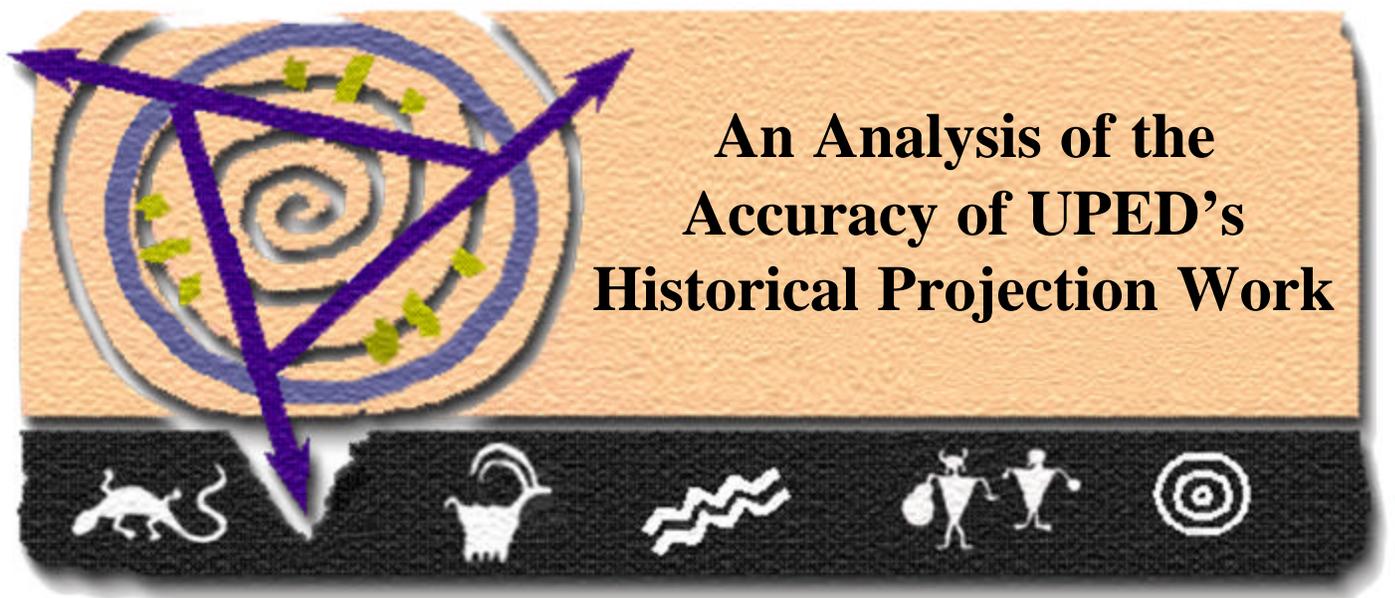


State of Utah Economic and Demographic Projections



**An Analysis of the
Accuracy of UPED's
Historical Projection Work**

Demographic and Economic Analysis
Governor's Office of Planning and Budget
April 2001

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State of Utah
Governor's Office of Planning and Budget
Demographic and Economic Analysis
116 State Capitol
Salt Lake City, Utah 84114

www.governor.state.ut.us/dea

Phone: (801) 538-1027

Fax: (801) 538-1547

April 2001

State of Utah

Governor's Office of Planning and Budget

Lynne N. Ward, CPA, Director

Natalie Gochmour, Deputy Director / State Planning Coordinator

Demographic and Economic Analysis Section

Neil Ashdown, Ph.D., Manager, DEA

Peter Donner, Senior Economist, Fiscal Impact Analysis

Scott Frisby, Research Analyst, QGET and Economic Forecasting

Lisa Hillman, Research Analyst, State Data Center Coordinator

Jamie Hyde, Research Analyst, State Data Center Contact

Ross Reeve, Research Consultant

Lance Rovig, Senior Economist, Economic and Revenue Forecasts

Robert Spendlove, Research Analyst, State Data Center Contact

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I. Introduction

For more than three decades, the Utah Process Economic and Demographic (UPED) model has been used to make fourteen series of baseline projections. These series differ in the number of years projected; the frequency in number of years (i.e., annual, biannual, or five year increments); the institutions, persons, and resources involved in making the projections; and the source and quality of input data. The ex post accuracy of each series has been determined by changing economic conditions and trends over the projection interval relative to the assumptions made about the future at the time of the projections. Accordingly, the results of the projections are reported each year in the *Economic Report to the Governor (ERG)*, often with revised projections as new data become available. The resulting collection of projections embodies differing degrees of projection accuracy. Included in this analysis are the results of several different sets of accuracy tests, reported from different baselines and ERGs, measured against official estimates for MCD and school-age populations, and against the 2000 Census statewide population numbers.

II. Methodology

Accuracy was measured specifically for certain segments of the 1984 and 1987 baseline projections series, and for the results published in the 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, and 2001 ERGs.

The absolute value percentage error (APE) was calculated for each entry in each projection series in order to determine the accuracy of past population projections. The APEs were derived by using the following formula:

$$[A_T - P_T] / A_T$$

where A is the actual population, P is the projected population, and T is the amount of time between the launch year (L) and the projection year (Y), also referred to as the forecast interval.

In cases where it is appropriate, such as when numerous APEs have been calculated for a series of projections, the mean APE, or MAPE, has been calculated. The MAPE is an important indicator of the accuracy of the entire projections series, versus a specific projection of one MCD for instance. Generally, the MAPE increases as the number of forecast intervals increase, as accuracy levels tend to deteriorate the further the projection year is from the launch year.

III. Results

The attached charts provide visual comparisons between actual population figures and projected populations, which were reported as actual baseline projections or published in ERGs, in each series for the State of Utah, MCDs, and school-age populations. The projections, while varying in accuracy percentage-wise, all performed the most essential functions of long-term projections, they mapped the trends. A good example of this is the chart entitled, "UPED Historical School-Age (5-17 Years Old) Population Projections." On this chart, the pattern of an initial increase, then a leveling off, then a dramatic jump in the early years of the 2000 decade of the school-age population, is clearly evident. The mapping of such trends is essential information for policymakers, and the trend of the growth pattern is far more important than the actual numbers.

IV. Observations

While a thorough understanding of the value and meaning of these measurements of projection accuracy is still a topic for further research and discussion, this structured and simple treatment of error illuminates several important points about projections.

- 1) Utah's projection history includes periods of both over and under projecting population.
- 2) Projections in any given period are significantly impacted by the most recent trends.
- 3) Generally, smaller relative projection errors occur in regions with larger populations and visa versa.
- 4) Utah's projection effort has consistently had the largest errors in the boom-bust regions and the rapidly growing areas.
- 5) While the accuracy of these projections is important, no measure of accuracy can indicate the importance of these projections in the planning and planning-coordination process. Among others, the projection process provides an organizing framework for discussions concerning long-term resource commitments.

V. Implications for the Future

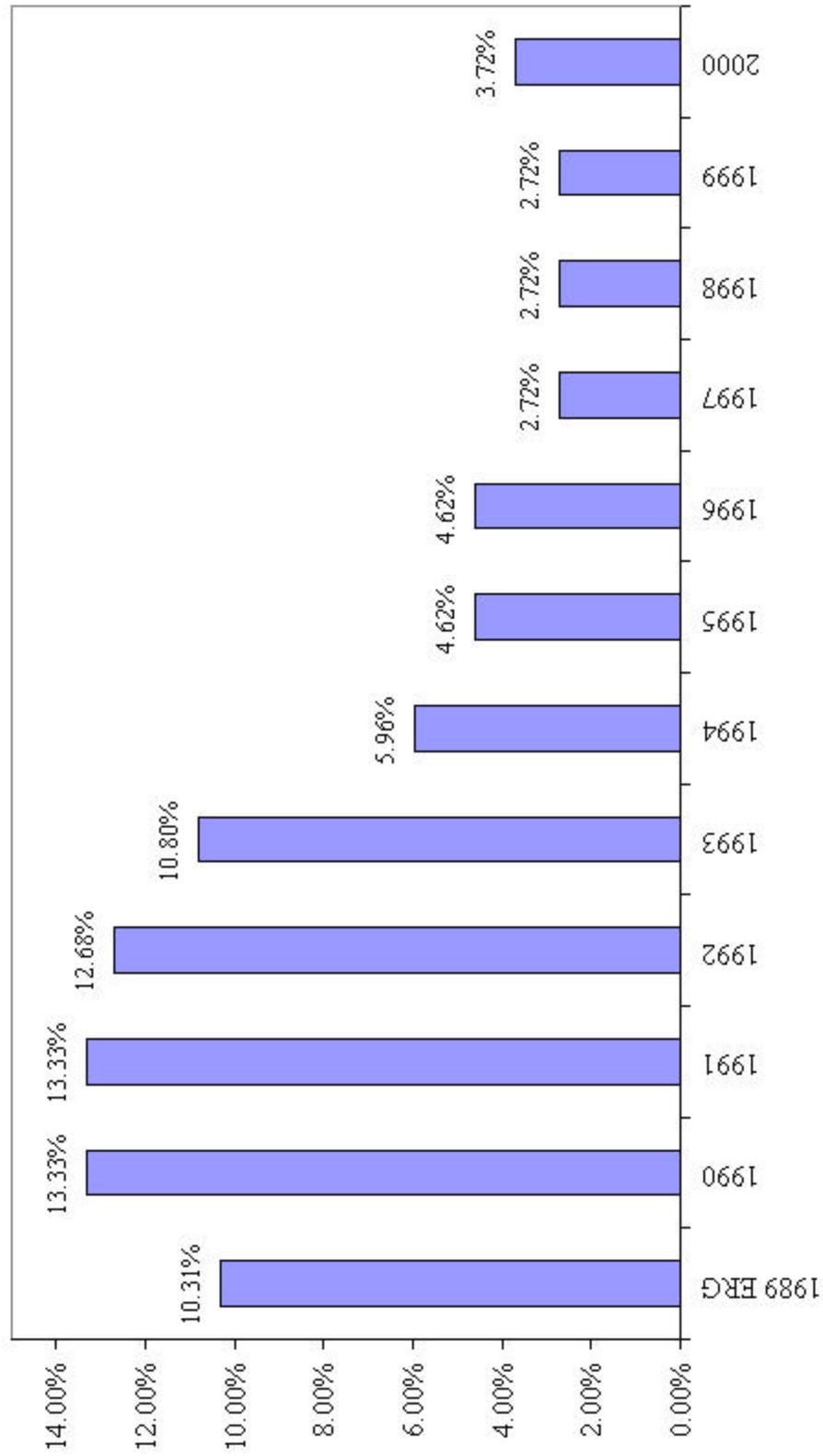
The Governor's Office of Planning and Budget is committed to continued improvements in its population and employment projection effort. This description of the past projection accuracy is intended to contribute to these efforts. Current demographic and economic projection research is focused on measuring and reducing forecast error, and GOPB is constantly striving to improve the methods it uses. Some of the changes that were implemented in the latest baseline include using new methods for generating assumptions about fertility, survival, labor force participation, and basic employment growth. The latest baseline also extended the projection period from 2020 to 2030, which allow for significant long-term planning.

VI. Appendix

The following is a list of charts that can be found in the attached pages.

- 1) Absolute Percentage Errors (APE's) for State of Utah
Projected 2000 Population vs. 2000 Census Counts
- 2) Multi-County District Population
Actual vs. Projected
- 3) Absolute Percentage Errors (APE's)
Projections of 1995 Populations
- 4) UPED Historical School-Age (5-17 Years Old) Population Projections
- 5) UPED School-Age Population Numbers
- 6) Absolute Percentage Error (APE)
School-Age Population Projections
- 7) Actual School Enrollments vs. 1987 Baseline Projections
- 8) 1987 Baseline Numbers vs. Actual Enrollment Numbers
- 9) MAPE's for Projection Series by ERG Year
- 10) Absolute Percentage Errors (APE's)
1987 School-Age Population Projections

**Chart 1:
 Absolute Percentage Errors (APE's) for State of Utah
 Projected 2000 Population vs. 2000 Census Counts**



ERG Years Projections Were Published

**Chart 2:
Multi-County District Population
Actual vs. Projected**

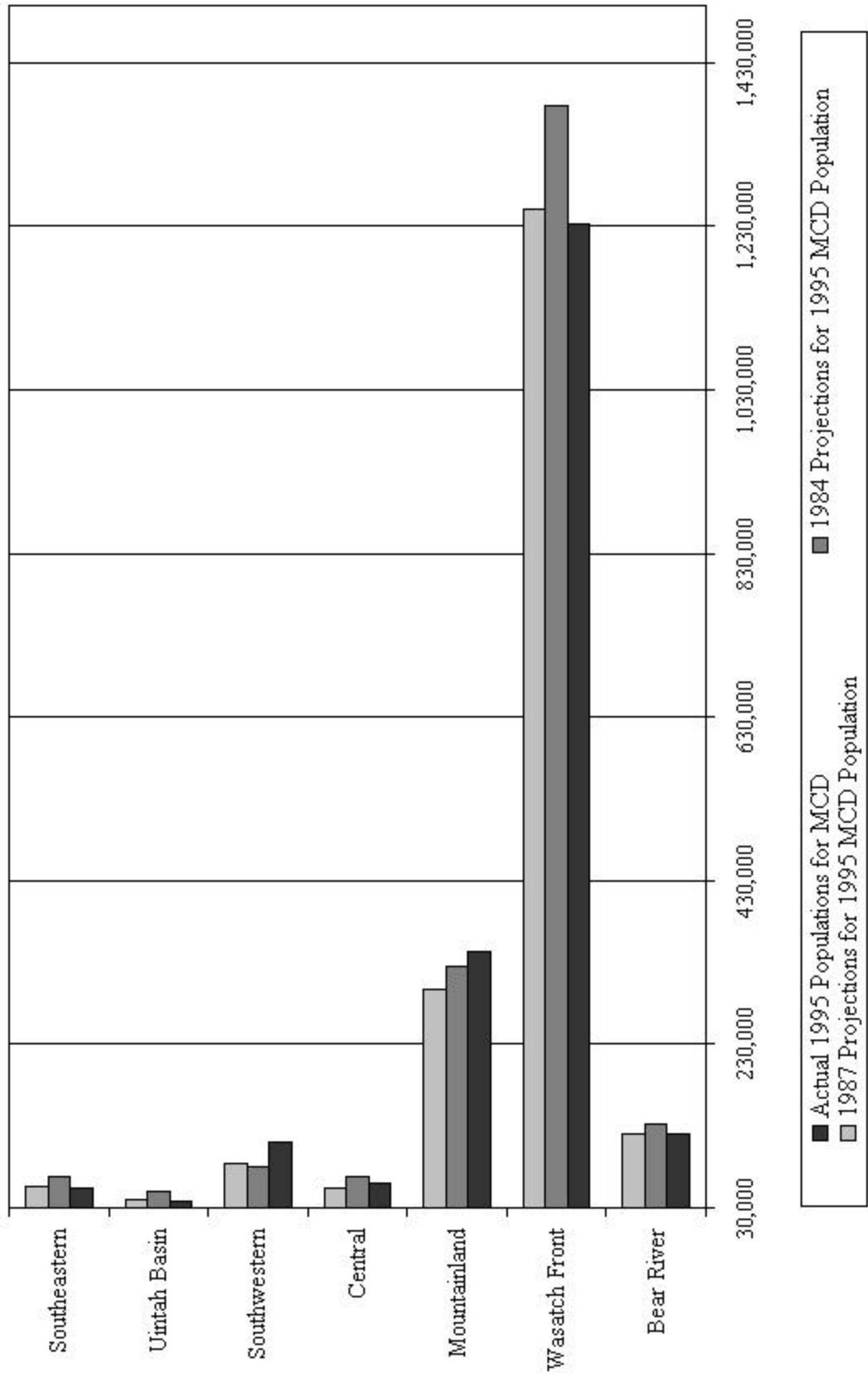


Chart 3:
Absolute Percentage Errors (APE's)
Projections of 1995 Populations

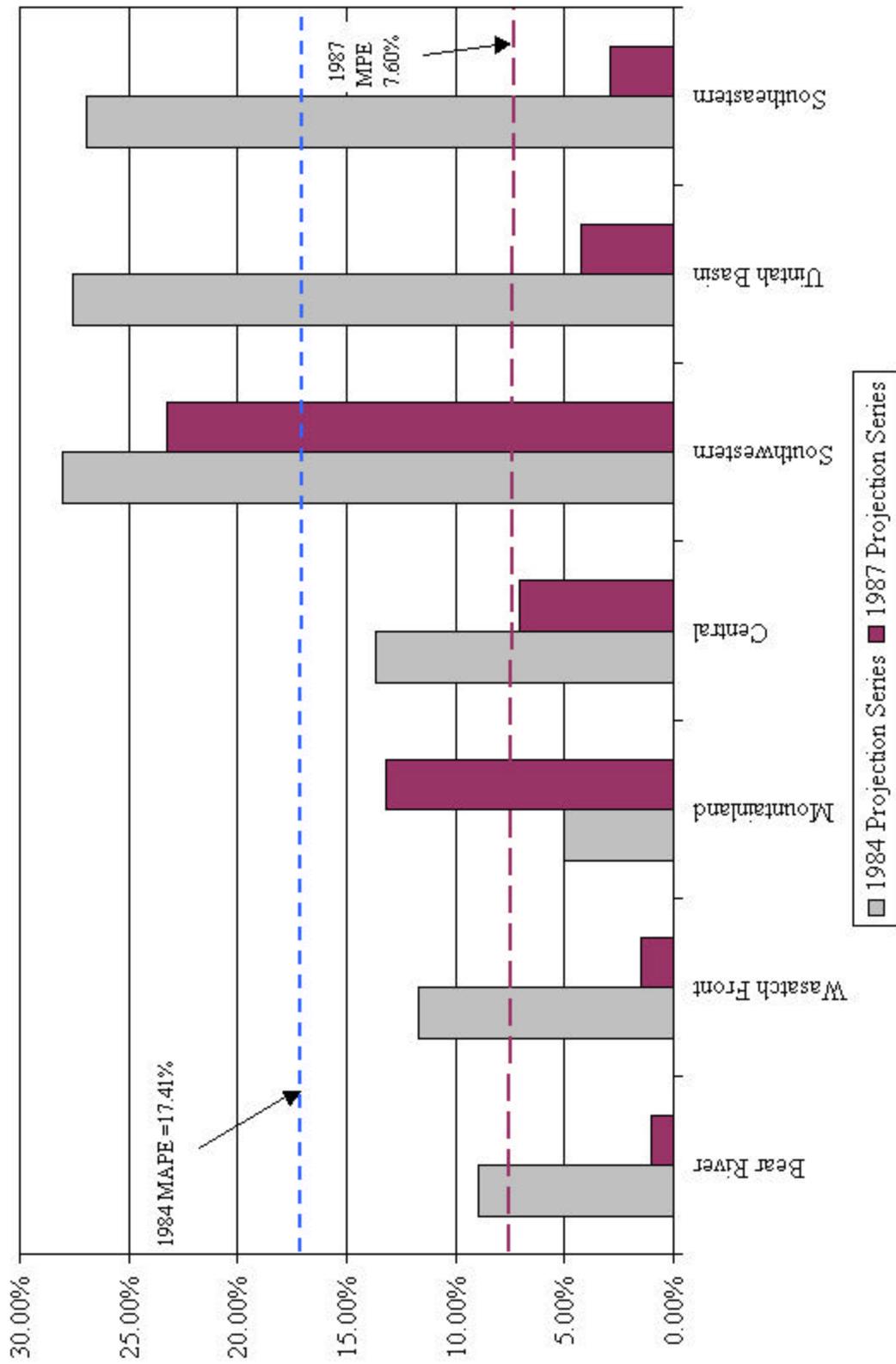


Chart 4:
 UPED Historical School-Age (5-17 Years Old) Population Projections

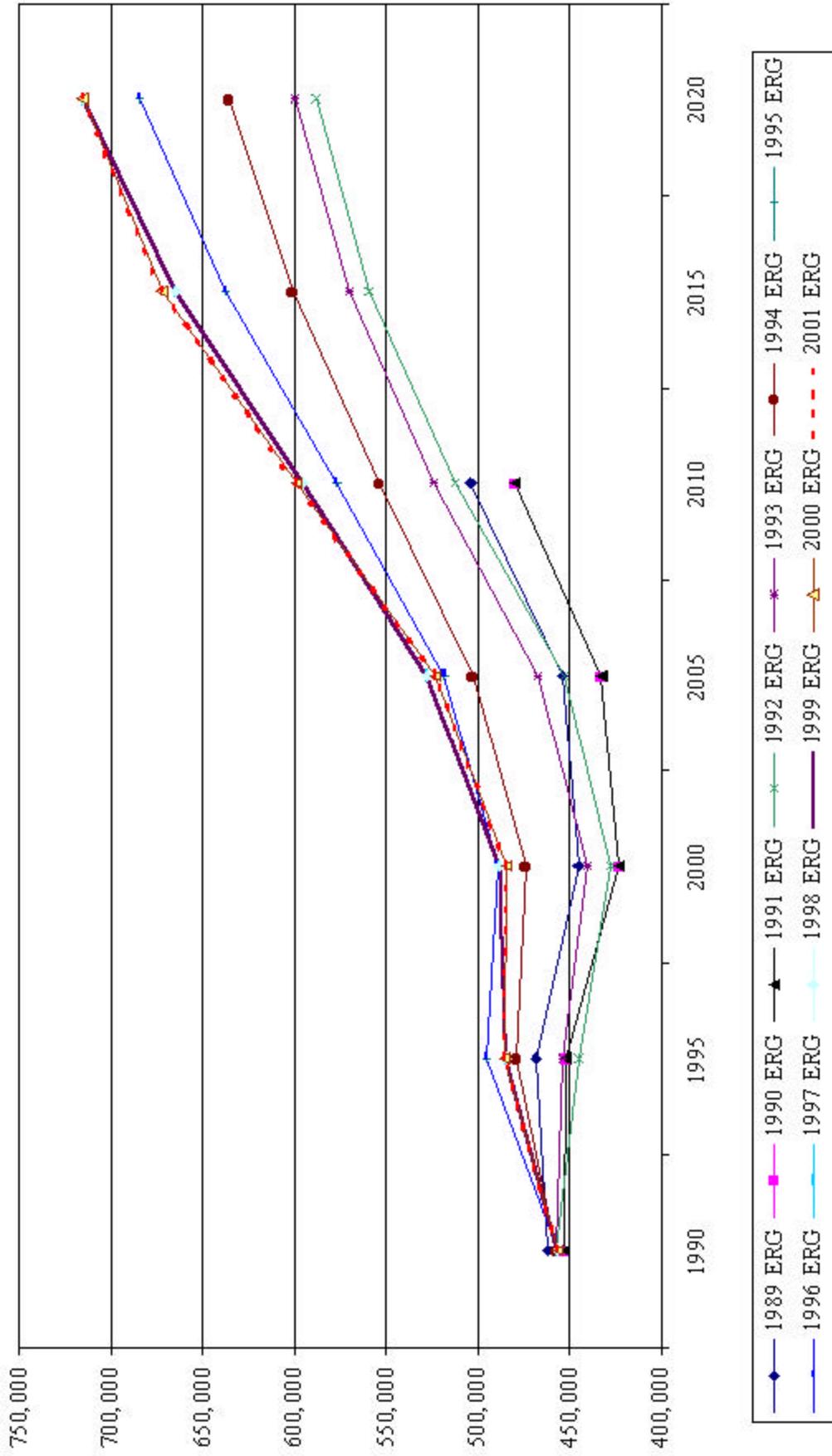


Chart 5:
UPED School-Age Population Numbers

Year	1989 ERG*	1990 ERG	1991 ERG	1992 ERG	1993 ERG*	1994 ERG*	1995 ERG
1990	462,000	452,885	452,885	457,811	457,811	457,811	456,783
1995	468,000	452,324	452,324	445,263	454,000	479,000	494,940
2000	445,000	423,437	423,437	427,802	440,000	474,000	489,629
2005	454,000	432,424	432,424	452,581	467,000	503,000	518,578
2010	504,000	479,873	479,873	512,458	524,000	554,000	576,706
2015	na	na	na	559,796	570,000	601,000	637,527
2020	na	na	na	588,573	600,000	636,000	684,414

Year	1996 ERG	1997 ERG	1998 ERG	1999 ERG	2000 ERG	2001 ERG
1990	456,783	456,783	456,783	456,783	456,783	456,783
1995	494,940	484,736	484,736	484,736	485,336	485,336
2000	489,629	488,630	488,630	488,630	484,305	484,305
2005	518,578	527,869	527,868	527,868	523,315	523,315
2010	576,706	595,035	595,035	595,035	598,775	598,775
2015	637,527	664,012	664,012	664,012	672,057	672,057
2020	684,414	715,361	715,362	715,362	715,815	715,815

*The 1989, 1993, and 1994 ERG's published rounded figures

Chart 6:
 Absolute Percentage Error (APE)
 School-Age Population Projections

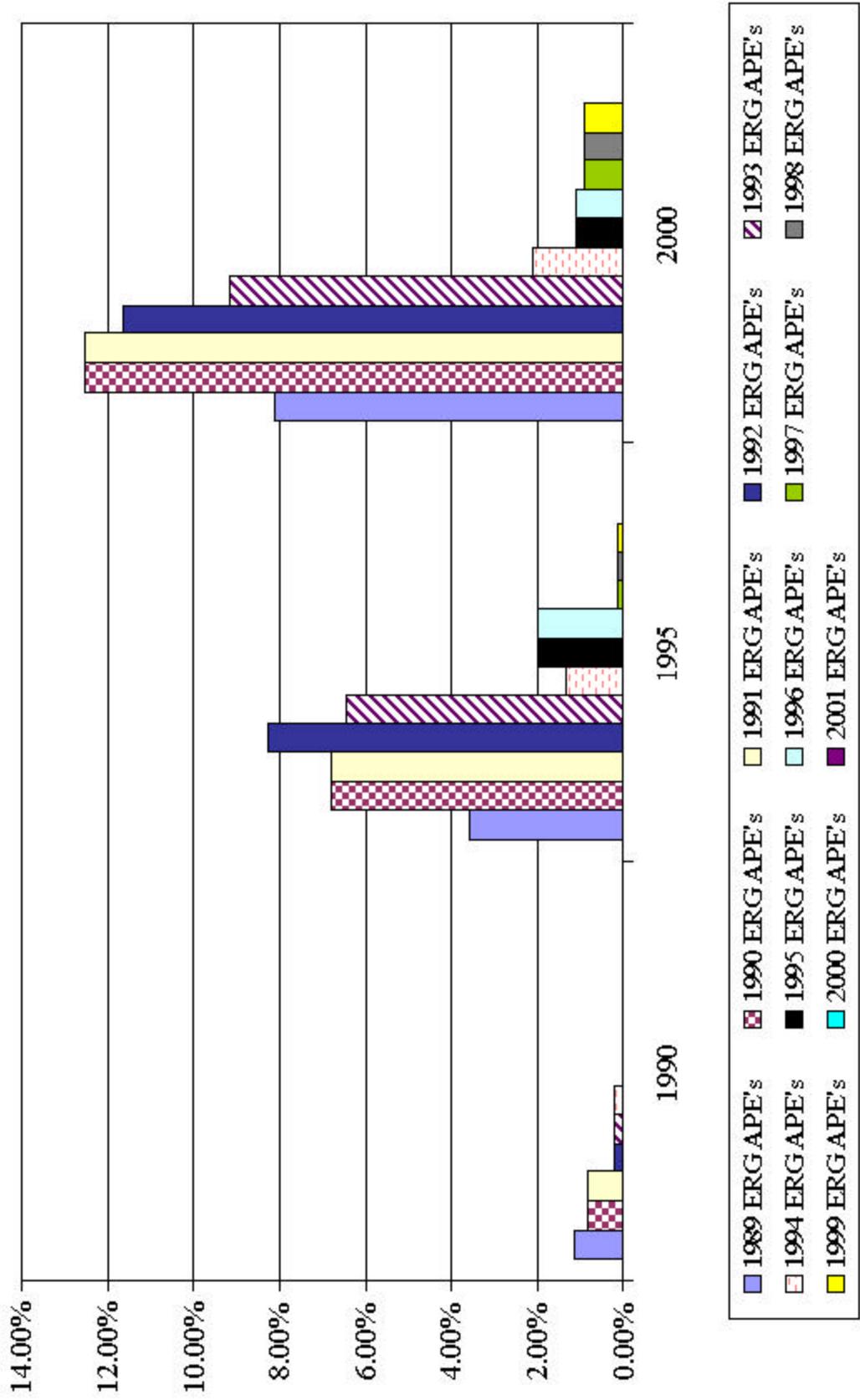


Chart 7:
Actual School Enrollments vs. 1987 Baseline Projections

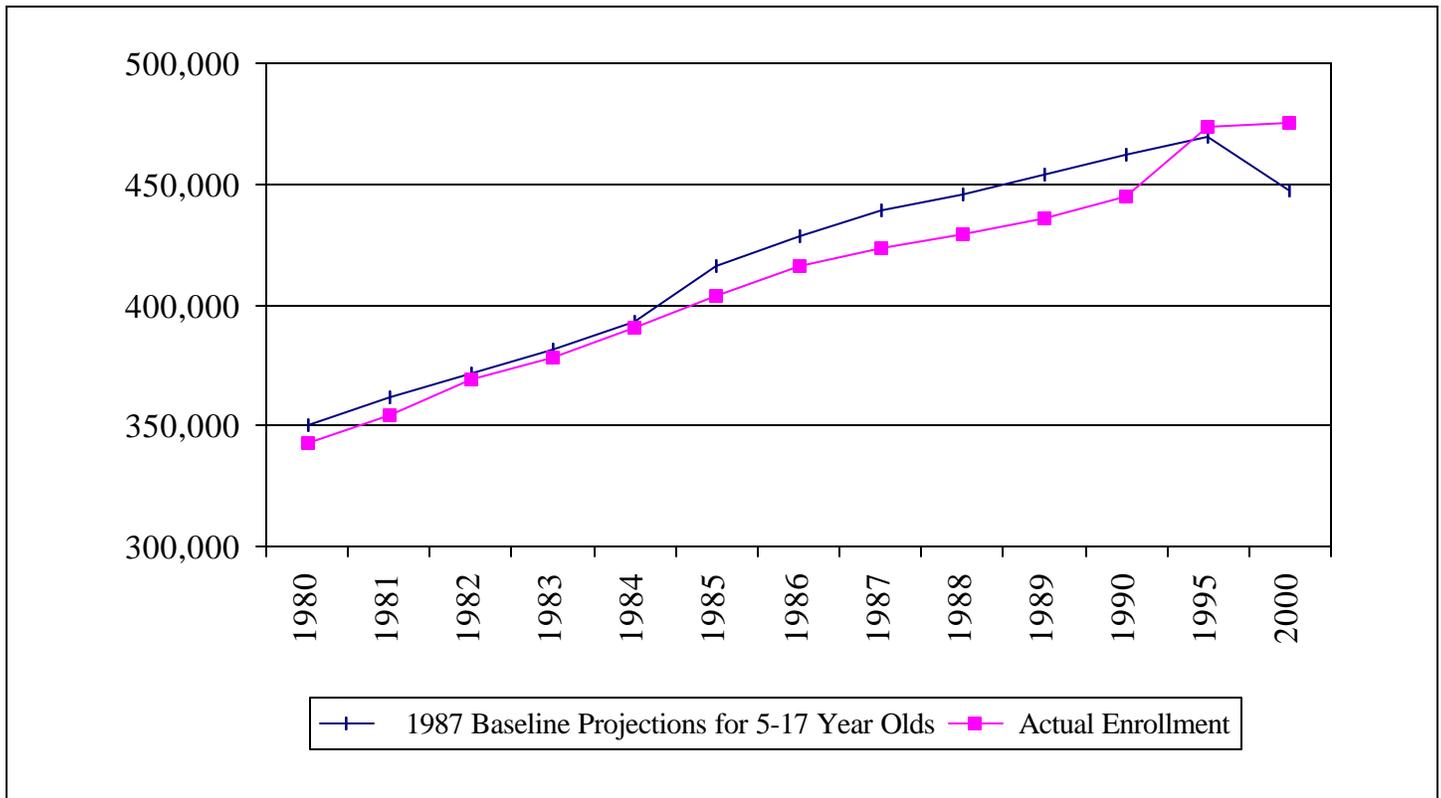
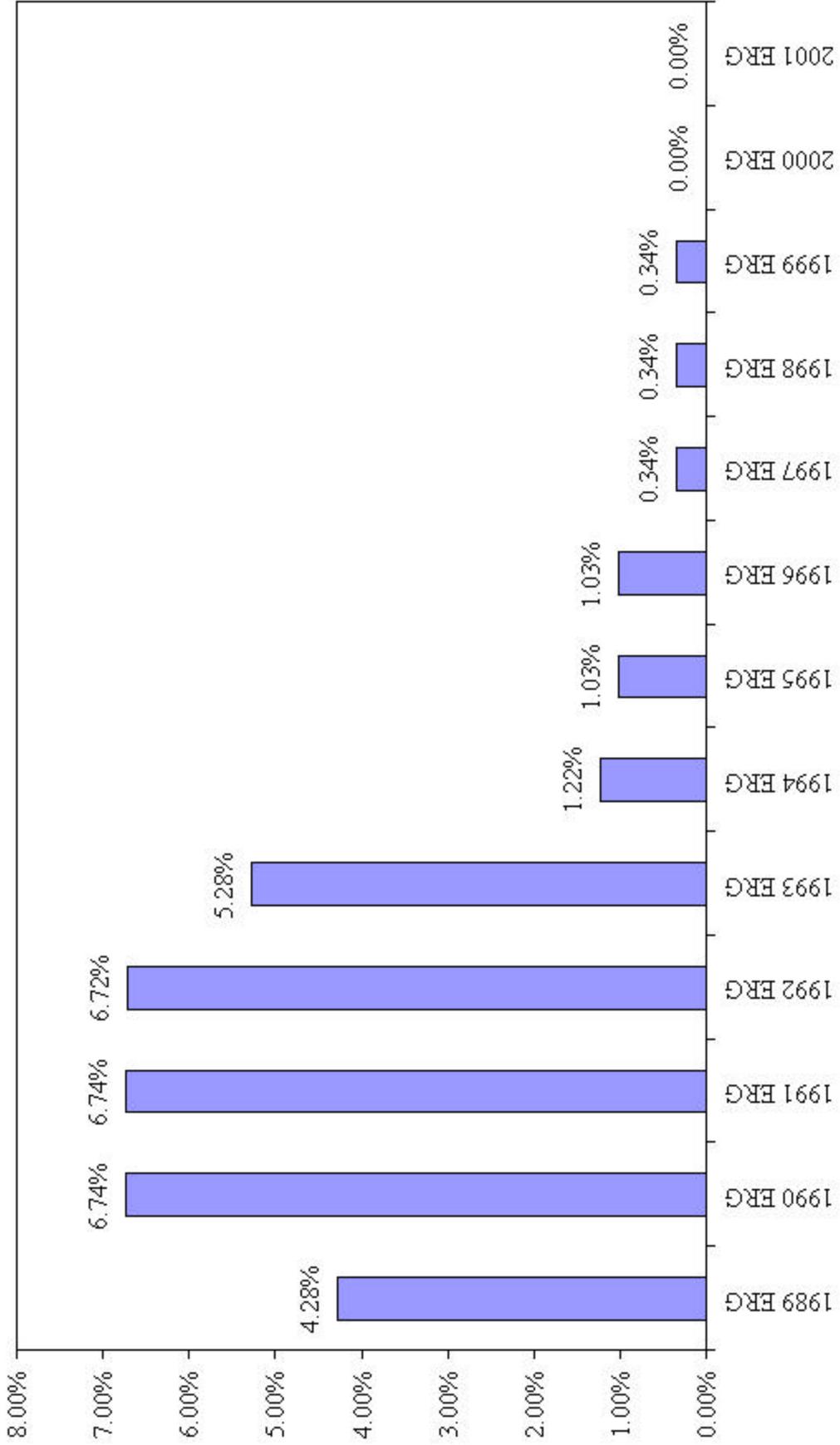


Chart 8:
1987 Baseline Numbers vs. Actual Enrollment Numbers

	1987 Baseline Projections for 5-17 Year Olds	Actual Enrollment
1980	350,143	342,885
1981	361,407	354,540
1982	371,240	369,338
1983	381,859	378,208
1984	393,172	390,141
1985	416,439	403,305
1986	428,593	415,994
1987	438,907	423,386
1988	445,818	429,551
1989	453,897	435,762
1990	462,334	444,732
1995	469,910	473,666
2000	447,445	475,343

Chart 9:
MAPE's for Projection Series by ERG Year



ERG Projection MAPE's for 1990, 1995, and 2000 School-Age Populations (Assumes that the 2000 and 2001 ERG Projections Display Actual Numbers)

Chart 10:
 Absolute Percentage Errors
 1987 School-Age Population Projections

