Uncertainty of Population and Employment Projections: Forecast Accuracy and Bias

The forecast error is usually defined as the difference between the population forecast for a particular geographic area in a particular target year and the actual population for the same area and year. Forecast errors are oftentimes measured as mean error (ME), mean absolute error (MAE), mean algebraic percent error (MALPE), mean absolute percent error (MAPE), mean squared error (MSE), root mean squared error (RMSE), root mean squared percent error (RMSPE), etc. MAPE, a measure in which positive and negative values do not offset each other, is one of the most popular error measures. MALPE is a popular measure of the forecast bias, which shows a general tendency to be high or low.

There have been empirical findings on the factors affecting the forecast accuracy. Those factors include projection method, population size, population growth rate, length of horizon, length of base period, launch year, etc. It is commonly found that no single method consistently produces more accurate projections than any other, forecast accuracy increases with population size, and forecast accuracy decreases with population growth rate and the length of projection horizon. A forecast bias also occurs when there are consistent differences between actual outcomes and previously generated forecasts.

There is no empirically established range of acceptable forecast errors by level of geography and length of horizon due to a variety of contexts for population projections. Instead the typical MAPEs for population projections by level of geography and length of horizon are proposed by a group of experienced demographers (Smith, Tayman, Swanson, 2001). For 20-year projection horizon, the State level population projections would be different from the actual population at 12% of MAPE, while the County level population projections would be different from the actual population at 24% of MAPE

The SCAG region's population projections are generally found accurate and are within an acceptable range of typical errors. The SCAG region's population projections show 9% difference of MAPE than actual population for 20-year projection horizon as a result of comparison of eight series of population projections with actual populations. The 9% of MAPE from the SCAG region's population projections for 20-year projection horizon is smaller than 12% of a typical MAPE from the state level population projections. Probably the regular update of the regional population projections occurred every three or four years might have contributed to the maintenance of the reasonable forecast errors. The SCAG region's population projections tend to show MALPE of -4% for the 20-year projection horizon, which means lower projections than the actual estimate during the same projection horizon.

The SCAG region's employment projections generally show a higher MAPE of 12% than population projections, and tend to show MALPE of 5 % for the 20-year projection horizon, which means higher projections than the actual estimate during the same projection horizon.

Table 1. Mean Absolute Percent Error (MAPE) and Mean Algebraic Percent Error (MALPE) of SCAG Region Population and Employment Projections (as of 2015)

		Projection Horizon			
		5 year	10 year	15 year	20 year
MAPE	Population	3%	6%	8%	9%
	Employment	5%	10%	15%	12%
MALPE	Population	0%	-1%	-3%	-4%
	Employment	-1%	1%	3%	5%
	Observations	12	11	10	7

Note: MAPE = |PEt|/n, PEt = [(Ft – At)/At] * 100, where PE represents the percent error, t the target year, F the population projection, A the actual population, and n the number of areas; MALPE = PEt/n; The intermediate years' projections were calculated using the compound growth rate.

Sources: SCAG, SCAG Development Guide - Growth Forecast Selection, Jan. 1974 (SCAG90 adopted in 1972); SCAG, SCAG Development Guide - Growth Forecast Selection, Jan. 1974 (D/E 2a adopted in 1974); SCAG, SCAG-76 Growth Forecast Policy, Jan 1976 (adopted in December 1975); SCAG, SCAG78 Growth Forecast Policy (adopted in January 1979); SCAG, SCAG82 Growth Forecast Policy (adopted in October 1982); SCAG, Growth Management Plan (adopted in February 1989); SCAG, Regional Comprehensive Plan and Guide (adopted in June 1994); SCAG, 1998 RTP Growth Forecast (adopted in April 1998); SCAG, 2001 RTP Growth Forecast (adopted in April 2001); SCAG, 2004 RTP Growth Forecast (adopted in April 2004); SCAG, 2008 RTP Integrated Growth Forecast (adopted in April 2008); SCAG, 2012 RTP/SCS Growth Forecast (adopted in April 2012)

Reference

Smith, Stanley K., Tayman, Jeff, Swanson, David A. 2001. State and Local Population Projections: Methodology and Analysis. New York: Kluwer Academic/Plenum Publishers.