Using Medicare Data for Short-Run Projections of the Elderly Population

Stanley K. Smith
University of Florida

Abstract: *As the elderly population of the United States grows in absolute number and as a proportion of total population, accurate projections of that population become increasingly important for sound policy decisions. Cohort component techniques are typically used for state and local projections of the elderly population, but are often outdated or even nonexistent for many local areas. This paper suggests an alternative approach, based on Medicare data and simple projection techniques. Projections for several base periods and projection horizons are made for all states and for counties in Florida and are compared with actual Medicare enrollment. On the basis of these comparisons it appears that Medicare data and simple projection techniques can produce very useful short-run projections of the elderly population for states and local areas.*

INTRODUCTION

The elderly population of the United States is large and growing rapidly. (In this paper the elderly population is defined as all persons age 65 and above.) In 1980 there were 25.5 million persons age 65 and above, an increase of 27% since 1970. By the year 2000 the elderly population is projected to grow to 34.9 million and by the year 2025, to 58.8 million (U.S. Bureau of the Census, 1984, Table 6). In 1950 only one out of twelve residents of the United States was age 65 and above. By 1980 this proportion had increased to one out of nine, and by 2025 it is projected to be almost one out of five.

Changes in the size of the elderly population have a major impact on many aspects of life in states and local areas. These changes affect the demand for hospitals, nursing homes, and other types of health services. They affect the demand for housing, public transportation, and recreational facilities. They affect employment patterns and labor force participation rates. They affect tax revenues and the distribution of public expenditures. They affect community attitudes and political behavior. Accurate projections are essential to adequately plan for the impact created by the rapidly changing size and distribution of the elderly population.

Projections of the elderly population are typically made using the cohort component method in which births, deaths, and migration are projected separately for each age and sex group in the population (e.g., Gillaspy, et al., 1978; U.S. Bureau of the Census, 1984). This method is very widely used and is generally accepted as the state of the art for population projections by age. Cohort component projections, however, are not available for many subcounty areas. They are often not available even for counties because no federal agency makes projections by age for all counties in

Address correspondence to Professor Stanley K. Smith, Bureau of Economic and Business Research, 221 Matherly Hall, College to Business Administration, University of Florida, Gainesville, Florida 32611.

Journal of Economic and Social Measurement 14:37–49 (1986)

0747-9662/86/$03.50

the United States. In addition, even when projections by age have been made for states or local areas, they frequently become quite outdated before a new set is produced.

Consequently planners and researchers are often faced with the necessity of making their own projections of the elderly population. Cohort component techniques could be used, but they require a substantial amount of detailed base data and technical expertise. Consequently, they are quite expensive. Furthermore, the data they are based on may themselves be somewhat outdated (e.g., migration rates from the previous decade). In this paper I suggest a quick, inexpensive alternative to the cohort component method for making short-run projections of the elderly population. This alternative uses Medicare data and several simple projection techniques. Using these techniques and data from 1970 to 1982, I produce and evaluate projections of the elderly population for the 50 states and the District of Columbia and, as an example of projections for local areas, for the 67 counties in Florida. On the basis of this analysis it appears that Medicare data and simple projection techniques can produce reasonably accurate short-run projections of the elderly population for states and local areas, providing a useful alternative to the cohort component method.

DATA

The Medicare program was established in 1965 to provide hospital and medical assistance to the aged (age 65 and above) and disabled (less than age 65). In this paper I focus exclusively on the elderly participants in the program, or those age 65 and above. With few exceptions, people become eligible for enrollment in the Hospital Insurance (HI) and/or Supplementary Medical Insurance (SMI) programs upon reaching age 65. Coverage by these two programs is very high. The largest group of persons explicitly excluded from enrollment is aliens with less than five years of continuous residence in the United States. Some federal employees were formerly excluded but are now permitted to enroll; their coverage is still incomplete because some have chosen to continue with their previous forms of medical insurance. A number of other persons remain outside the program because of failure to enroll. At the national level, however, enrollment of the elderly population in the Medicare program is believed to be very nearly complete (e.g., Irwin, 1978; Hatten, 1980).

Medicare data are tabulated by the Health Care Financing Administration of the Department of Health and Human Services. They are available by age, sex, and race for states, counties, and zip code areas for January 1 and July 1 of each year, beginning with July 1, 1966. This paper deals only with the total number of elderly enrollees (regardless of age, sex, and race) for states and the counties in Florida. A similar type of analysis could be performed for different geographic areas and for specific population subgroups.

While coverage by the Medicare program is generally quite good, there is not a perfect one-to-one relationship between elderly Medicare enrollees and the population age 65 and above enumerated in the decennial census. Differences may arise because of incomplete coverage by the Medicare program, census undercount or overcount, data error, differences in the dates for which data are collected, and differences in the ways in which residence is defined. Several of these factors require further explanation. The Medicare data used in this study refer to the number of elderly persons enrolled in the HI or SMI programs on July 1 of each year. The tabulation of these numbers, however, is not run on the computer until approximately nine months after that date, or around April 1 of the following year. Any changes in residence during that nine-month period are included in the tabulation. Thus the total number of enrollees is for July 1 of each year, but the residence reported by these enrollees is for April 1 of the following year. There is no way to resolve this problem, given the way the program is currently run. This is not a major problem in most places because migration rates for older persons tend to be relatively low. In a few places, however, it can add to the discrepancy between the number of elderly Medicare enrollees and the census count of persons age 65 and above.

The determination of place of residence can also lead to differences between Medicare and census data. The census attempts to count people at their "usual" place of residence, or the place they live and sleep most of the time. For people with a single residence, this is not a problem. For those with more than one, however, the proper determination of permanent residence can be difficult. For example, if a person from Ohio spends the winter in Florida, he/she might be counted in the census as a Florida resident while the Medicare file shows him/her to be an Ohio resident, or vice versa. For some states and counties the existence of second homes creates a substantial discrepancy between Medicare and census data. Both Medicare and census data are based on the addresses claimed by individual persons. If the two differ, it is impossible to determine which more accurately reflects "usual" residence. Fortunately (for statistical purposes) only a relatively small proportion of older persons have more than one residence, and the residency problem has a significant effect on the data only in a relatively small number of states and counties.

For the United States there were 24.9 million Medicare enrollees age 65 and above on April 1, 1980. (April 1 numbers were calculated as a linear interpolation between July 1 numbers.) The 1980 Census counted 25.5 million persons in that age category, or 2.6% more than the Medicare enrollment. This represents a change since 1970, when the census population age 65 and above exceeded Medicare enrollment by only 0.4%. This change was most likely due to a more nearly complete census count in 1980 than 1970 (or perhaps even an overcount of the elderly population in the 1980 census).

The relationship between the census population age 65 and above and elderly Medicare enrollees for all states (including the District of Columbia) and the counties in Florida is summarized in Table 1. The census count exceeded Medicare enrollment in 43 states, but the differences were usually quite small: less than 2% in 24 states and less than 5% in 46 states. In no state was the difference greater than 8%. The differences were generally smaller in the northern and eastern states than in the southern and western states. The ratio of census population age 65 and above to elderly Medicare enrollees changed by less than 2% between 1970 and 1980 in 24 states, and by less than 5% in 46 states, indicating a high degree of stability over the decade. In all 50 states and the District of Columbia this ratio was higher in 1980 than 1970, reflecting the more nearly complete count in the 1980 census.

For counties in Florida the differences between census counts and elderly Medicare enrollees were considerably larger than they were for states. Differences were less than 2% in only nine of the state's 67 counties and were greater than 20% in 10 counties. While differences for counties would normally be expected to be larger than differences for states, the differences are probably greater in Florida than in most states because of the large number of seasonal residents that frequent the state.

Between 1970 and 1980 the ratio of census population age 65 and above to elderly Medicare enrollees changed by less than 2% in 14 of Florida's counties, by less than 5% in 35 counties, and by less than 10% in 49 counties. In five counties it changed by more than 20%. These were all small counties; four of the five had fewer than 1000 elderly residents in 1970. For large counties the ratio was quite stable between 1970 and 1980. In the nine Florida counties with more than 30,000 persons age 65 and above in 1970, the ratio of census population age 65 and above to Medicare enrollees changed by an average of only 1.8% between 1970 and 1980. In none of these counties was the change greater than 3.2%.

The data for states thus show a close and fairly stable relationship between the number

Table 1. Relationship between Census Population Age 65 and Above and Elderly Medicare Enrollees, 1980

		States							
Population age 65 and above	Number	Census greater than Medicare	Medicare greater than census	Percent differences					
				<1	1–2	2–3	3–4	4–5	5+
<100,000	11	5	6	6	1	0	1	1	2
100,000–399,999	18	17	1	4	4	4	2	3	1
400,000+	22	21	1	3	6	4	5	2	2
Total	51	43	8	13	11	8	8	6	5
		Florida Counties							
Population age 65 and above	Number	Census greater than Medicare	Medicare greater than census	Percent differences					
				<2	2–5	5–10	10–15	15–20	20+
<2000	14	12	2	0	3	3	3	2	3
2000–4999	17	15	2	2	0	7	3	2	3
5000–24,999	21	18	3	5	1	7	3	2	3
25,000+	15	13	2	2	2	8	2	0	1
Total	67	58	9	9	6	25	11	6	10

of elderly Medicare enrollees and the census population age 65 and above. For counties in Florida the relationship is not as close nor as stable, but the correlation between the two sources of data is still quite strong (especially for large counties). In the states and counties where Medicare and census data differ significantly, it is not clear which provides a better measure of the "true" population age 65 and above. In some respects Medicare data may be better. For example, Medicare age data may be more reliable than census age data because enrollees must be able to document their ages. In the census, one's age does not have to be documented. It is based solely on self-enumeration, and the misreporting of age in censuses is well known (e.g., Shryock and Siegel, 1973, Chap. 8). In other respects census data may be better, such as when Medicare coding procedures assign geographically borderline residents to the wrong county. In some respects it is impossible to determine which is better. For example, the address claimed as usual residence is based on self-enumeration in both the decennial census and the Medicare program; either, neither, or both may be consistent with the official guidelines for determining place of residence.

In this paper Medicare data are used as a measure of the population age 65 and above. There is a great deal of precedent for this, as the Census Bureau uses Medicare data to indicate postcensus changes in the elderly population (e.g., U.S. Bureau of the Census, 1976) and to evaluate the coverage of the decennial census (e.g., U.S. Bureau of the Census, 1977). Some techniques for combining Medicare data with census data will be discussed in a later section of this paper.

PROJECTION TECHNIQUES

Annual Medicare data for persons age 65 and above were collected for each state and each county in Florida for every year between 1970 and 1982. July 1 Medicare numbers were adjusted to April 1 by means of linear interpolation. Data from 1966 to 1969 were excluded from the analysis because coverage by the Medicare program was incomplete during the first several years of operation. Three sets of projections were made for 1982, one using data from 1970 to 1975, one using data from 1970 to 1977, and one using data from 1970 to 1979. Five simple projection techniques were used.

The first technique was simple regression (REGR-1), in which the number of Medicare enrollees was regressed on time. This technique incorporates data from every year in the base period and assumes a linear relationship between Medicare enrollees and time:

$$MED_{82} = a + bt \qquad (1)$$

where MED_{82} is Medicare enrollees in 1982, a is the intercept, b is the regression coefficient for time, and t is the number of years in the projection horizon.

The second technique was multiple regression (REGR-2), in which the number of Medicare enrollees was regressed on time and time squared. This technique incorporates data from every year in the base period but allows for a nonlinear relationship between Medicare enrollees and time:

$$MED_{82} = a + bt + ct^2 \qquad (2)$$

where c is the regression coefficient for time squared.

The third technique was linear extrapolation (LINEX), which incorporates data only from the first and last year in the base period. This technique assumes that the absolute annual change in Medicare enrollees over the projection horizon will be the same as the average annual change during the base period:

$$MED_{82} = MED_i + (82 - i)(MED_i - MED_{70})/(i - 70) \qquad (3)$$

where MED_i = Medicare enrollees in year i (i = 75, 77, or 79).

The fourth technique was exponential extrapolation (EXPO), in which future annual growth rates are projected to be the same as the average annual growth rate during the base period:

$$MED_{82} = MED_i\, e^{rt} \qquad (4)$$

where e is the natural exponential function, r is the average annual growth rate between 1970 and year i, and t is the number of years between year i and 1982.

A fifth technique was evaluated as well. That technique (AVE) projects the number of Medicare enrollees in 1982 as the equally weighted average of the projections derived from the other four techniques.

These are very simple projection techniques. There is a common perception (among both producers and users of population projections) that forecast accuracy improves as projection techniques become more complicated and/or sophisticated. However, there is little evidence to indicate that this is true. On the contrary, numerous authors have concluded that simple projection techniques generally produce forecasts that are every bit as accurate as those produced by more sophisticated techniques, at least in the short run (e.g., Hajnal, 1955; Greenberg, 1972; Siegel, 1972; Ascher, 1978; Smith, 1984). The simplicity of the techniques employed in this study should not be interpreted to mean that they are inferior techniques in terms of forecast accuracy. The empirical results will indicate whether or not these techniques produce reasonably accurate projections.

PROJECTION RESULTS

States. Three sets of projections for 1982 were made for the 50 states and the District of Columbia using the five techniques described above. Three-year projections were based on data from 1970 to 1979, five-year projections were based on data from 1970 to 1977, and seven-year projections were based on data from 1970 to 1975. The projections were then compared to actual Medicare enrollment in 1982. The results of these comparisons are summarized in Tables 2 and 3. Table 2 shows mean absolute percentage errors, or the average when the sign of the error is ignored. Table 3 shows the number of states in which the 1982 projections were above and below the actual 1982 enrollment and the number of states with large, medium, and small errors.

Several patterns are apparent from these tables. First, errors tend to increase with the length of the projection horizon. This is a common finding in studies of the forecast accuracy of population projections (e.g., Schmitt and Crosetti, 1951; Siegel, 1953; Isserman, 1977; Smith, 1984). For all five techniques the mean absolute percentage error was greater for the seven-year projections than the five-year projections, and greater for the five-year projections than the three-year projections. This result was found for states in all three size categories, as well as for the entire sample. The number of small errors (less than 2%) declined as the projection horizon increased, while the number of large errors (5% and above) increased. This result was found for all five techniques.

Second, errors tend to decline as the size of the base population increases. This too is a common empirical result (e.g., White, 1954; Irwin, 1977; Isserman, 1977; Smith, 1984). The mean absolute percentage error for states with fewer than 100,000 Medicare enrollees in 1970 was greater than the mean error for states with 100,000 or more for all five techniques and all three projection horizons. These differences were often quite large. The differences seem to disappear, however, after the base population reaches a certain size. There were no significant differences in errors between the two largest size categories (100,000–399,999; 400,000 and above). Errors were larger in the top category than the middle category almost as often as the reverse

Table 2. Projections of Elderly Medicare Enrollees: Mean Absolute Percentage Errors for States

Number of Enrollees, 1970	Number	REGR-1	REGR-2	LINEX	EXPO	AVE
		Three-Year Projections				
<100,000	14	3.3	1.0	2.4	1.3	1.7
100,000–399,999	22	1.4	1.0	1.0	1.0	0.7
400,000+	15	1.4	0.7	1.1	1.2	0.9
Total	51	1.9	0.9	1.4	1.1	1.1
		Five-Year Projections				
<100,000	14	4.7	1.6	4.1	2.2	2.9
100,000–399,999	22	2.1	1.2	1.8	1.4	1.2
400,000+	15	2.0	1.4	1.6	1.6	1.1
Total	51	2.8	1.4	2.4	1.7	1.6
		Seven-Year Projections				
<100,000	14	6.0	2.8	5.7	3.1	4.0
100,000–399,999	22	2.9	2.7	2.7	2.1	1.9
400,000+	15	2.9	2.0	2.6	2.7	1.8
Total	51	3.7	2.5	3.5	2.6	2.4

Table 3. Projections of Elderly Medicare Enrollees: Distribution of Errors for States

Projection technique	Number	High	Low	Distribution of errors <2	2–5	5–10	10+
		Three-Year Projections					
REGR-1	51	12	39	33	16	1	1
REGR-2	51	43	8	49	2	0	0
LINEX	51	13	38	43	6	2	0
EXPO	51	23	28	45	4	2	0
AVE	51	19	32	48	2	1	0
		Five-Year Projections					
REGR-1	51	8	43	23	22	4	2
REGR-2	51	36	15	39	11	1	0
LINEX	51	11	40	29	19	1	2
EXPO	51	18	33	37	12	2	0
AVE	51	15	36	37	12	1	1
		Seven-Year Projections					
REGR-1	51	8	43	17	22	10	2
REGR-2	51	32	19	23	21	7	0
LINEX	51	8	43	18	22	9	2
EXPO	51	15	36	24	21	4	2
AVE	51	13	38	28	19	2	2

was true. Distinctions with respect to the size of the base population thus appear to be critical only below a certain level.

While no single technique stands out as clearly superior to the others in this sample, the two nonlinear techniques (REGR-2, EXPO) generally performed better than the two linear techniques (REGR-1, LINEX). The average errors were smaller for the nonlinear techniques in all three projection horizons, sometimes by a large amount. The nonlinear techniques had more small errors and fewer larger errors than the linear techniques. The superiority of the nonlinear techniques was consistent across size categories and for all three projection horizons.

All the techniques except REGR-2 tended to produce 1982 projections that were smaller than the actual number of 1982 enrollees. The two linear techniques had a particularly strong downward bias: 43 of the seven-year projections for both REGR-1 and LINEX were found to be low. For all five techniques the number of low projections increased with the length of the projection horizon (conversely, the number of high projections declined). The general tendency for these techniques to produce low projections is most likely due to the fact that the number of Medicare enrollees was increasing by constantly larger annual increments over the period covered by this study. This was the result of trends in the the birth rate during the early twentieth century, the decline in mortality rates since 1970, and possibly the increased coverage by the Medicare program during the 1970s. Whatever the cause, the negative bias for states was quite small and certain adjustments based on the projected size of the national elderly population could be applied to counteract it.[1]

Counties. The same type of analysis that was done for states was done for the 67 counties in Florida. The results are summarized in Tables 4 and 5. Several of the patterns found for states were also found for counties. Errors increased with the length of the projection horizon. For all five techniques and all four population size categories, mean absolute percentage errors were greater for the seven-year than the five-year projections, and for the five-year than the three-year projections. For all five techniques the number of small errors declined as the projection horizon increased, while the number of large errors increased.

Errors for counties also generally declined as the size of the base population increased. Although there was not a perfect monotonic relationship between size of error and size of elderly population for every technique and every projection horizon, the general negative relationship stands out clearly in Table 4. As for states, the differences in errors between small and middle-sized counties were generally greater than the differences between middle-sized and large counties.

The projections for counties also showed a distinct downward bias. While the preponderance of low projections was greatest for the two linear techniques (REGR-1 and LINEX), there were more low than high projections for all five techniques in all three projection horizons. The EXPO technique came closer to an even split between low and high projections than any other technique. The cause of

Table 4. Projections of Elderly Medicare Enrollees: Mean Absolute Percentage Errors for Florida Counties

Number of Enrollees, 1970	Number	REGR-1	REGR-2	LINEX	EXPO	AVE
		Three-Year Projections				
<1000	14	8.9	7.2	7.6	6.3	7.0
1000–4999	26	6.3	2.8	4.7	3.7	3.9
5000–24,999	17	5.8	3.0	3.6	4.1	2.9
25,000+	10	4.7	2.4	3.2	5.1	3.0
Total	67	6.5	3.7	4.8	4.6	4.2
		Five-Year Projections				
<1000	14	11.0	13.2	10.9	8.1	10.4
1000–4999	26	8.6	6.7	8.0	6.4	6.6
5000–24,999	17	8.7	9.4	7.9	5.0	6.1
25,000+	10	6.7	5.1	5.9	7.8	5.2
Total	67	8.8	8.5	8.3	6.6	7.1
		Seven-Year Projections				
<1000	14	11.5	24.6	11.2	9.7	10.9
1000–4999	26	9.6	11.4	9.4	8.6	8.2
5000–24,999	17	9.1	17.8	9.4	8.5	8.6
25,000+	10	7.9	11.7	7.7	13.4	8.9
Total	67	9.6	15.8	9.5	9.5	9.0

Table 5. Projections of Elderly Medicare Enrollees: Distribution of Errors for Florida Counties

Projection technique	Number	High	Low	Distribution of errors <2	2–5	5–10	10–15	15–25	25+
				Three-Year Projections					
REGR-1	67	9	58	11	21	24	8	2	1
REGR-2	67	27	40	28	26	8	3	2	0
LINEX	67	12	55	21	19	21	3	3	0
EXPO	67	31	36	22	25	11	8	1	0
AVE	67	20	47	25	25	12	2	3	0
				Five-Year Projections					
REGR-1	67	9	58	9	15	20	14	7	2
REGR-2	67	17	50	12	11	25	9	6	4
LINEX	67	9	58	7	15	25	14	4	2
EXPO	67	26	41	16	17	19	6	9	0
AVE	67	14	53	14	13	24	10	4	2
				Seven-Year Projections					
REGR-1	67	12	55	10	10	23	9	12	3
REGR-2	67	22	45	1	12	17	10	12	15
LINEX	67	9	58	11	12	20	11	10	3
EXPO	67	31	36	8	18	21	7	5	8
AVE	67	20	47	9	18	16	13	7	4

the downward bias for counties was most likely the same as that mentioned for states.

The general patterns relating projections to length of projection horizon, population size, and bias were much the same for counties as for states. In several ways, however, the results for counties were considerably different from the results for states. The magnitude of the errors was substantially larger for counties than for states. For the AVE technique, for example, the mean absolute percentage errors were 1.1%, 1.6%, and 2.4%, respectively, for the three-year, five-year, and seven-year projections for states. For counties the corresponding errors were 4.2%, 7.1%, and 9.0%. Similar differences can be found for the other four techniques as well. Such results are not surprising, of course. County projections were based on much smaller population numbers than state projections, and growth rates varied much more from county to county than they did from state to state. Both of these factors caused county errors to be greater than state errors.

Another difference between the state and county results is the comparative performance of the five techniques. For the state projections the nonlinear techniques performed considerably better than the linear techniques in all three projection horizons. For the county projections such was not the case. For the three-year projections REGR-2 had much smaller mean absolute percentage errors than REGR-1, but for the five-year projections the errors were about the same, and for the seven-year projections the errors were much smaller for REGR-1 than for REGR-2. LINEX and EXPO had very similar overall errors in all three projection horizons, with EXPO generally having smaller errors in counties with small numbers of older persons and LINEX having smaller errors in counties with large numbers of older persons. No one technique or group of techniques stands out as clearly superior for the county projections.

Comparison of Errors. It would be interesting to compare the errors for the Medicare projections with errors from a standard cohort component projection model. Unfortunately, for counties in Florida there are no cohort component projections for the time period covered by this study. For states, however, there is a set of cohort component projections that can be used (U.S. Bureau of the Census, 1979). This set is based on population estimates for 1975 and provides projections for 1980. The elderly population from this set of projections can be compared to the 1980 census count for states, and the resulting errors can be compared with the errors from the five-year Medicare projections.

The cohort component projections evaluated in this study were taken from Series II-B of the Census Bureau projections, which was based on migration patterns from 1970 to 1975. Projections of the population age 65 and above in 1980 were compared with the 1980 census counts, and the percent errors were calculated. The results of this analysis showed an average error of 2.8%, considerably larger than the 1.6% error in the five-year projections of Medicare enrollees for AVE (Table 2). Forty-seven of the cohort component projections were below the 1980 census count, compared to 36 in the five-year projections for AVE. Only seventeen errors were less than 2% (compared to 37 for AVE) and four were greater than 5% (two for AVE).

The five-year Medicare projections were thus more accurate than the five-year cohort component projections, according to three different criteria. They were more precise, having a lower mean absolute error; they were less biased, having a more nearly even split of low and high projections; and they had more small errors and fewer large errors. While these results certainly do not prove that the simple projection techniques used in this paper are superior to the cohort component method, they do show a reasonably high level of accuracy and suggest the potential usefulness of Medicare-based projections when cohort component projections are outdated or unavailable.

DISCUSSION

Cohort component techniques are by far the most commonly used techniques for projecting population age groups. They offer several advantages over the techniques discussed in this paper, such as incorporating information on the total age structure of a population and allowing fertility, mortality, and migration assumptions to be altered independently of each other. They can also provide projections of the age, sex, and race characteristics of the elderly population. But for simply projecting the total number of older persons, the techniques discussed in this paper offer some advantages over cohort component techniques.

Medicare data are available annually while the census data required by cohort component techniques are typically available only once every ten years. Consequently projections based on Medicare data can utilize more recent information than cohort component projections. For example, Medicare projections made in 1986 will be able to utilize data through 1985 while cohort component projections will still be using migration data from 1975 (or even 1970) to 1980. Since migration patterns can change considerably within a few years, the use of more recent data is one advantage of the techniques described in this paper.

Cohort component projections are typically based on population data from two points in time, such as 1970 and 1980. Medicare projections, however, can incorporate data from every year in the base period. This may be critical for places where growth trends are changing. For example, the elderly population in a county may have grown by 6000 between

1970 and 1975 and by 2000 between 1975 and 1980. The 1970 and 1980 censuses will show only the total increase of 8000 during the entire decade, while the annual Medicare data will show the much more rapid growth during the first half of the decade than the second half. This additional information may be very useful in the preparation of population projections.

Perhaps the major advantage of the techniques discussed in this paper is their simplicity. The data requirements are minimal: the annual series of Medicare numbers. The projection techniques themselves are simple and require no formal demographic training or experience. They are well within the range of expertise of most people who might need to make such projections. Their cost in terms of time and money is quite small. Cohort component projections, on the other hand, are much more expensive, require more data and complex programming, and take much longer to produce. The Medicare data and techniques discussed in this paper can thus be used to revise the number of older persons shown in out-of-date cohort component projections or to provide projections of the elderly population for areas in which cohort component projections have not been made. They provide a useful alternative to cohort component projections.

Despite their simplicity, the projections discussed in this paper proved to be quite accurate, given current standards of forecast accuracy. At the state level the AVE projections had mean absolute errors of 1.1% for the three-year projection horizon, 1.6% for the five-year horizon, and 2.4% for the seven-year horizon. Forty-eight of the 51 errors for AVE were less than 2% for the three-year projections, 37 were less than 2% for the five-year projections, and 28 were less than 2% for the seven-year projections. Compared to studies of the accuracy of projections of the total population of states (e.g., White, 1954; Smith, 1984), this is quite a good record.

At the county level the errors were larger. The AVE projections had mean absolute errors of 4.2% for the three-year horizon, 7.1% for the five-year horizon, and 9.0% for the seven-year horizon. Fifty of the 67 errors for AVE were less than 5% for the three-year projections, 27 were less than 5% for the five-year projections, and 27 were less than 5% for the seven-year projections. Although the errors for counties were greater than the errors for states, these results are quite similar to those reported for projections of total population for local areas (e.g., Schmitt and Crosetti, 1953; Greenberg, 1972; Isserman, 1977; Smith, 1984).

Errors for counties in most states would likely be smaller than those reported here. The accuracy of projections is generally found to be lower for rapidly growing areas than slowly growing areas (e.g., Schmitt and Crosetti, 1951; Isserman, 1977; Smith, 1984). The elderly population in Florida is growing very rapidly. Between 1970 and 1980 the number of persons age 65 and above increased by more than 50% in 49 of the state's 67 counties; it more than doubled in 18 counties. Furthermore, many Florida counties have large numbers of seasonal, part-time elderly residents, adding the complications of double residency. Given these factors, the errors for the county projections in Florida do not seem to be unreasonably large. There is a good chance they would be considerably lower in most states.

An average of the projections derived from several techniques will most likely provide better results than relying on a single technique. This has frequently been found to be true for population estimates (e.g., Burghardt and Geraci, 1980). While some individual techniques produced smaller mean absolute percentage errors than AVE in certain size categories or for certain projection horizons, the differences were always quite small. More important, one cannot know in advance which specific technique will produce better results within a given time period or for a particular group of states and counties. For example, REGR-2 had relatively small errors for states but relatively large errors for counties, and its performance in relation to the other techniques tended to deteriorate as the length of the projection horizon increased. For the seven-year projections AVE had a smaller mean absolute percentage error and fewer large errors than any other technique; this held true for states and for the counties in Florida. It would seem likely that using an average of several techniques will minimize the risk of producing inaccurate projections, especially for longer projection horizons.

Medicare data and the decennial census offer two independent estimates of the "true" population age 65 and above. As shown in Table 1, the correspondence between elderly Medicare enrollees and the census population age 65 and above in 1980 was very close for most states, but not as close for most counties in Florida. A number of different techniques could be used to make the Medicare data consistent with census data. One technique is to add the projected increase in Medicare enrollees during the projection horizon (e.g., 1980 to 1985) to the census-enumerated population age 65 and above at the beginning of the projection period (e.g., 1980). This combination of Medicare data with census data is the technique used by the Census Bureau in its population estimation program (U.S. Bureau of the Census, 1976). Another adjustment technique is to multiply the projected Medicare enrollment (e.g., for 1985) by the ratio of census population age 65 and above in 1980 to the number of Medicare enrollees in 1980. This procedure assumes that this ratio is constant over time. An alternate assumption is that the ratio is changing in some predetermined way (e.g., county ratios converging toward the state ratio). Any of these adjustment techniques could be applied to the projections of Medicare enrollees described in this paper to make them consistent with the census population age 65 and above. Further testing is required to determine which of these techniques is the most accurate.

One final caveat should be mentioned. The projection techniques described in this paper should be used primarily for short-run projections of the elderly population. Beyond a time horizon of ten years or so, the continued extrapolation of past trends is not likely to provide very accurate projections. A comparison of the three-, five-, and seven-year projections in Tables 2–5 shows clearly the increase in errors that occurs as the projection horizon lengthens. For longer-run projections cohort component techniques will likely be more useful because they incorporate information on the entire age structure, which at the older ages changes fairly slowly and predictably. Long-run cohort component projections, of course, could easily be adjusted to fit with short-run projections based on Medicare data.

CONCLUSION

Medicare data provide a timely and generally reliable source of information on the elderly population in the United States. The data are available by age, race, and sex for states, counties, and zip code areas. They can be used with a number of simple extrapolation techniques to produce projections of the elderly population for states and local areas. Such projections have several advantages over traditional cohort component techniques: they can utilize more recent data, they can pick up changes in trends over time, and they are much simpler and less expensive to apply. Furthermore, the empirical analysis showed these projections to provide very accurate forecasts of the elderly population for states, and fairly accurate forecasts of the elderly population for the counties in Florida. Consequently, it appears that Medicare data and simple extrapolation techniques can be very useful in revising outdated cohort component projections or providing current projections of the elderly population for areas in which cohort component projections have not been made.

NOTE

1. The size of the elderly population of the United States is changing in a very stable and predictable manner. Consequently accurate short-run projections of the national

elderly population can be made. An adjustment factor based on past and projected future changes in the size of the national elderly population could be developed and applied to the state and county projections described in this paper. Such an adjustment would most likely reduce the downward bias found in the empirical analysis.

REFERENCES

Ascher, William (1978). Forecasting: An Appraisal for Policy-Makers and Planners. Baltimore: Johns Hopkins University Press.

Burghardt, John A., and Geraci, Vincent J. (1980). State and local annual population estimation methods employed by the Bureau of the Census. Review of Public Data Use 8(4):339–354.

Gillaspy, R. Thomas, DeJong, Gordon F., and Keppel, Kenneth G. (1978). A methodology for projecting the older population of local areas. Review of Public Data Use 6(5):25–33.

Greenberg, Michael (1972). A test of combinations of models for projecting the population of minor civil divisions. Economic Geography 48(2): 179–188.

Hajnal, John (1955). The prospects for population forecasts. Journal of the American Statistical Association 50:309–322.

Hatten, James (1980). Medicare's common denominator: The covered population. Health Care Financing Review Fall:53–64.

Irwin, Richard (1977). Guide for Local Area Population Projections. Technical Paper No. 39, Washington, D.C.: U.S. Bureau of the Census.

Irwin, Richard (1978). Aggregate medicare enrollment by age, sex and race as a resource in analyzing demographic change for local areas. paper presented at NBER Workshop on Policy Analysis with Social Security Research Files, Williamsburg, Virginia, March 15–17.

Isserman, Andrew (1977). The accuracy of population projections for subcounty areas. Journal of the American Institute of Planners. 43(3): 247–259.

Schmitt, Robert, and Crosetti, Albert (1951). Accuracy of the ratio method for forecasting city population. Land Economics 27(4):346–348.

Schmitt, Robert, and Crosetti, Albert (1953). Short-cut methods of forecasting city populations. Journal of Marketing 17(4):417–424.

Shryock, Henry, and Siegel, Jacob (1973). The Methods and Materials of Demography. Washington, D.C.: Bureau of the Census, Government Printing Office.

Siegel, Jacob S. (1952). Forecasting the population of small areas. Land Economics 29(1):72–88.

Siegel, Jacob S. (1972). Development and accuracy of projections of population and households in the United States. Demography 9(1): 51–68.

Smith, Stanley K. (1984). Population Projections: What Do We Really Know? Monograph No. 1, Bureau of Economic and Business Research, University of Florida, Gainesville.

U.S. Bureau of the Census (1976). Current Population Reports, Series P-25, No. 640.

U.S. Bureau of the Census (1977). Current Population Reports, Series P-23, No. 65.

U.S. Bureau of the Census (1979). Current Population Reports, Series P-25, No. 796.

U.S. Bureau of the Census (1984). Current Population Reports, Series P-25, No. 952.

White, Helen R. (1954). Empirical study of the accuracy of selected methods of projecting state population. Journal of the American Statistical Association 49(27):480–498.