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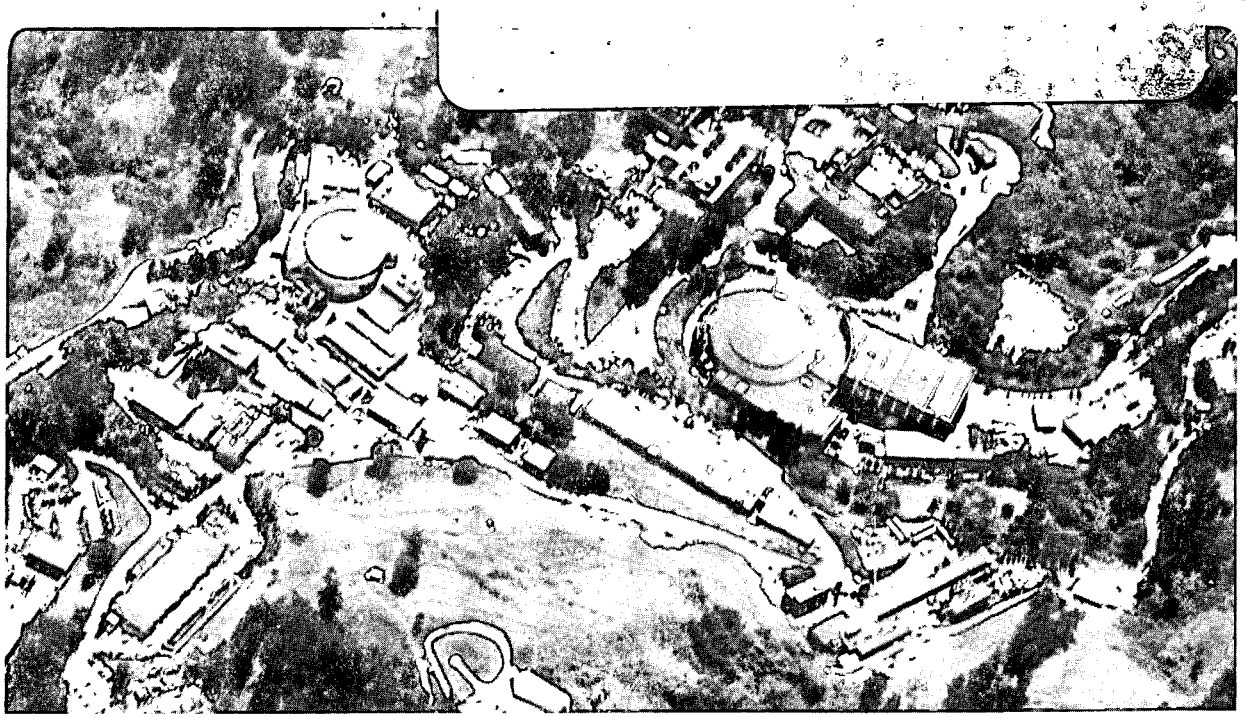

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THE TESTING OF LOCAL-LEVEL LABOR FORCE AND UNEMPLOYMENT PROJECTIONS

May 1987

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THE TESTING OF LOCAL-LEVEL LABOR FORCE AND UNEMPLOYMENT PROJECTIONS

For several years, Lawrence Berkeley Laboratory has been using a projections model to provide projections at the local level of population, labor force and unemployment by race, sex and age for over 1200 substate areas. The labor force and unemployment projections use the population projections and rely on the assumption that local trends can be approximated by national trends. Now that Summary Tape File 4 (STF4) of the 1980 Census has become available, it is possible to test these assumptions by comparing the projections against actual data. The tests show that local changes in the labor force can be approximated by national trends whereas local changes in unemployment do not follow national trends.

THE TESTING OF LOCAL-LEVEL LABOR FORCE AND UNEMPLOYMENT PROJECTIONS

1. Introduction

For several years, Lawrence Berkeley Laboratory (LBL) has collaborated with the US Department of Labor's Employment and Training Administration (ETA) to provide analysts in the State Employment Security Agencies (SESAs) and in the Service Delivery Areas (SDAs) as defined under the Job Training Partnership Act (JTPA) with some of the data needed for their planning. They require estimates of the target population that they will serve in the coming year. They require the data for a variety of administrative areas which are usually counties, cities or aggregates therof, and which range in size down to units as small as 100,000 in population. Program planning requires demographic data about the population, the labor force, and the unemployed population, broken out by race, sex, and age. Furthermore, the data are needed as projections for the next calendar year.

Such statistics are not generally available for substate areas. They are available only for the years covered by the decennial censuses. However, by the time even these data are released, they are at least two years old and sometimes older. Thus, a model was developed to provide short term projections of the population, labor force, and unemployment by race, sex and age for about 1200 substate areas [Schroeder, 1985a]. To be consistent from state to state as well as within states, the projections are calculated using a uniform methodology and nationally available data.

The population projections by race, sex and age are calculated using the cohort-component method [Irwin, 1977, Pittenger, 1976, and Shryock, Siegel and Associates, 1973]. This depends upon sex- and age-specific fertility, mortality, and migration rates. National or state level fertility and mortality rates are used as there is not a great deal of variation from place to place. Obtaining age-specific net migration rates for a given area is much more difficult. A considerable amount of developmental work has been done to try to improve the migration component [Schroeder and Pittenger, 1983].

The labor force and unemployment projections by race, sex, and age are calculated using a ratio method [Irwin, 1977, Pittenger, 1976, and Shryock, Siegel and Associates, 1973]. For postcensal years, there are little data on the labor force and unemployment at the substate level. National changes are well covered however. The January issue of *Employment and Earnings* contains annual averages for the preceeding year [U.S. Bureau of Labor Statistics, 1986]. The ratio method relies on the assumption that local changes in labor force and unemployment rates by race, sex and age can be approximated by the corresponding national changes. The specifics of how the ratio method is used are covered in Section 2.

In summary, the labor force and unemployment projections depend upon a very simple technique - the ratio method - and upon the previously calculated

population and labor force projections, respectively. Is it reasonable to use such a simple method, i.e., are the resultant errors tolerable? or should a more sophisticated method be developed?

The purpose of this paper is to test the merits of using the ratio method. What are the resultant errors? What would be the errors if the population projections were "correct"? In other words, how much of the error in each projection process is due to the methodology of the process and how much is due to the use of previously calculated projections?

Section 2 briefly outlines the methodology of the labor force and unemployment projections. Section 3 covers the testing of the models and the results. Section 4 summarizes the results and suggests where future efforts should be directed.

2. Methods

The purpose of both the labor force and the unemployment projections is to provide race, sex and age detail on the projected civilian labor force and unemployment. These models do *not* project the overall level of labor force participation or the total number of persons unemployed. These totals must be obtained from an independent source as inputs for the model.[1] Using the projected total labor force and the total number of unemployed as controls, the models estimate the race, sex and age breakdown.

When this model was developed, it used the 1970 Census as a base.[2] There was more demographic detail for the labor force than for unemployment. For the civilian labor force, 1970 Census data were available at the local level for the two sexes, seven age groups ((16-17), (18-19), (20-24), (25-34), (35-44), (45-64), and (65+)), and three racial groups (white, black and other) [U. S. Bureau of the Census, 1972a]. The only unemployment data available in the 1970 Census for all areas across the U.S. were for the two sexes and the three racial categories (white, black and other), i.e., no age detail. Thus, the labor force projections are done for two sexes, three races, and seven age groups; whereas the unemployment projections are calculated for just the two sexes and three racial groups.

The labor force and unemployment projections models follow essentially the same methodology. The labor force projections model assumes that local changes in labor force participation rates by race, sex and age can be approximated by the corresponding national changes in labor force participation rates. The base-year local area labor force participation rates are multipled by these

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[1]These totals are provided by analysts at the state or local level. One possible source is an extrapolation of current labor force and unemployment data available in the Local Area Unemployment Statistics (LAUS) series in the Bureau of Labor Statistics' LABSTAT.

[2]In the early 1980's, the base year 1970 Census data in all models were replaced with 1980 Census data. However, since the purpose of this paper is to compare projections from 1970 to 1980 with 1980 Census data, the following will discuss the model as based on the 1970 Census.

national changes to yield preliminary labor force participation rates by race, sex and age for the target year. Multiplying these rates by the corresponding population projections yields labor force projections by race, sex and age. These preliminary labor force projections are then controlled to an independent state-provided estimate of the total labor force to give the final labor force projections by race, sex and age for the local area.

The preceding paragraph also summarizes the unemployment projections model when the words labor force participation rates are replaced with the words unemployment rates, and when the words population projections are replaced with the words labor force projections. The only difference is the lack of age detail in the unemployment projections. The local area data and the national changes in unemployment are race- and sex-specific only.

The first step in both projections is to adjust the base year local area labor force and unemployment rates, respectively. The rates obtained from the 1970 Census measure the labor force and unemployment in late March or early April, 1970. These rates are multiplied by race, sex and age-specific factors to convert them to annual averages compatible with the annual averages of the Current Population Survey (CPS). These adjusted local area labor force and unemployment rates are then projected to obtain the average labor force and unemployment rates by race, sex and age for the local area for the target year.

2.1. Labor Force Projections

The labor force projections use

1) the labor force participation rates by race, sex and age of the local area in the base year,
2) national changes in labor force participation rates by race, sex and age,
3) the population projections by race, sex and age for the local area for the target year as already calculated, and
4) an independent estimate of the total labor force in the area in the target year.

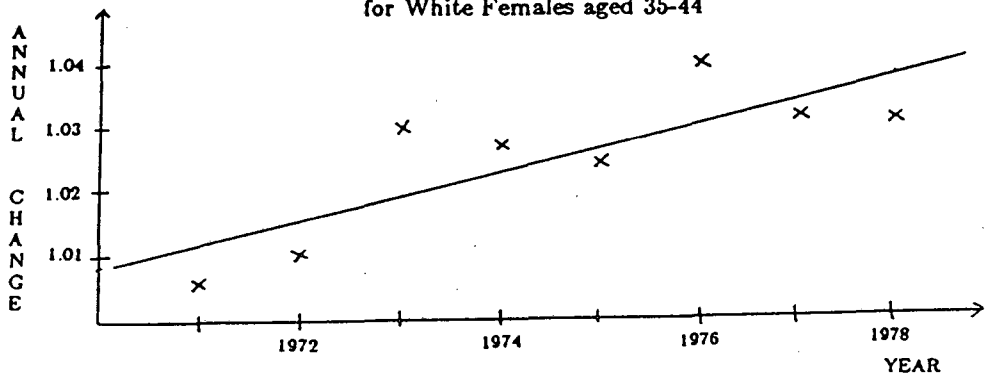
The base year local area labor force participation rates can be obtained from the decennial census - either directly or by aggregating over several geographic areas [U.S. Bureau of the Census, 1972a, or U.S. Bureau of the Census, 1982a].

National changes in labor force participation rates by race, sex and age are obtained from the annual averages obtained from the Current Population Survey (CPS) [U.S. Bureau of Labor Statistics, 1986]. The annual averages for a given year are available in January of the following year. However, the labor force projections are done for a time period one year into the future and thus require labor force participation rates for one year into the future. On the assumption that changes in national labor force participation rates over the past 10 or 12 years will continue for the near term, the trend in the more recent annual averages for each race, sex and age group is used to estimate the labor force participation rate in the next year for the corresponding race, sex and age group. The greatest change is in the increased female labor force participation in the age groups 25-34 and 35-44. The methodology assumes that this trend will continue.

To determine these trends by race, sex and age, a regression line is fitted to the annual change in labor force participation rates as a function of time. For each race, sex and age group ijk, the fitted regression line is used to estimate a national labor force participation rate for the target year. In the following discussion, assume that annual labor force participation rates by race, sex and age are available for the years 1970 through 1978, LF_{ijk}^{70} through LF_{ijk}^{78}, and that the labor force participation rates by race, sex and age for 1980 are to be estimated, $\hat{LF}_{ijk}^{80}$. Figure I shows the annual change in labor force participation rates for white females aged 35-44 as a function of time. For example, the point for 1971 is calculated as $LF_{wf\,35}^{71} \;/\; LF_{wf\,35}^{70}$. The figure shows that the labor force participation rates for white females aged 35-44 increased every year from 1970 to 1978 and increased more as the decade progressed. The fitted line reflects this increase. Although this increase may continue for the short-term, it clearly can not continue for more than several years. This line can be extended to yield change factors for 1979 and 1980 and eventually $\hat{LF}_{wf\,35}^{80}$.[3] The estimated labor force participation rates for 1980 $\hat{LF}_{ijk}^{80}$, are divided by the corresponding rates for 1970, LF_{ijk}^{70}, to obtain the national change from 1970 to 1980, N_{ijk}.

$$N_{ijk} = \hat{LF}_{ijk}^{80} \;/\; LF_{ijk}^{70}. \tag{1}$$

FIGURE 1 – Annual Change in Labor Force Participation Rates for White Females aged 35-44



The labor force participation rates in the local area a, LF_{ijka}^{70}, are multiplied by these national changes to obtain labor force participation rates for the target year, $\hat{LF}_{ijka}^{80}$.

$$\hat{LF}_{ijka}^{80} = N_{ijk}^{70\text{-}80} \times LF_{ijka}^{70}. \tag{2}$$

Multiplying these labor force participation rates by the previously projected population, P_{ijka}^{80}, gives preliminary labor force projections by race, sex and age, $\hat{L}_{ijka}^{80}$.

$$\hat{L}_{ijka}^{80} = \hat{LF}_{ijka}^{80} \times P_{ijka}^{80}. \tag{3}$$

[3]For 1979 and 1980, this line estimated labor force participation rates for white females aged 35-44 of 63.2 and 66.0 respectively; whereas the actual data values were 63.0 and 65.0.

The final labor force projections are obtained by forcing these numbers to sum to the local area control total independently provided.

2.2. Unemployment Projections

The methodology used to create the unemployment projections is very similar to that used for the labor force projections. These projections are calculated by the use of

1) the unemployment rates by race and sex of the local area in the base year,
2) national changes in unemployment rates by race and sex,
3) the labor force projections by race and sex for the local area for the target year as already calculated, and
4) an independent estimate of the total number of unemployed in the local area in the target year.

The base year local area unemployment rates can be obtained from the decennial census - either directly or by aggregating over several geographic areas [U.S. Bureau of the Census, 1972a, or U.S. Bureau of the Census, 1982a].

As with the labor force projections, the most important step is to obtain national changes from 1970 to the target year. However, current economic conditions have a much greater impact on unemployment rates than on labor force participation rates. To eliminate economic changes and much of the cyclicality of unemployment rates, the 1970 unemployment rate of each race/sex group, UR_{ij}^{70}, is divided by the total unemployment rate, UR^{70}.

$$S_{ij}^{70} = UR_{ij}^{70} / UR^{70}. \tag{4}$$

For a race/sex group, ij, whose unemployment is the same as the total unemployment rate, $S_{ij}^{70}=1$. For race/sex groups with less unemployment, $S_{ij}^{70}<1$, and for those race/sex groups with more unemployment, $S_{ij}^{70}>1$. National changes, C_{ij}, are determined by comparing these ratios rather than the actual unemployment rates.

As with the labor force participation rates, the annual changes in these ratios were regressed against time. In general, the fits were very poor since they were dominated by the two expansion periods of 1971-1974 and 1976-1979. Thus, instead of trying to extrapolate to the target year, the national changes, C_{ij}, are estimated as the ratios for the latest year for which data are available, N, divided by the ratios for 1970. Thus,

$$C_{ij} = S_{ij}^{N} / S_{ij}^{70}. \tag{5}$$

The unemployment rate ratios in the local area a, S_{ija}^{70}, as obtained from the Census, are multiplied by the national changes to obtain ratios of unemployment rates for the local area in the target year. These ratios are then multiplied by the total unemployment rate of the area, UR_a^{80}, to yield unemployment rates by race and sex, $\hat{UR}_{ija}^{80}$.

$$\hat{UR}_{ija}^{80} = S_{ija}^{70} \times C_{ija} \times UR_{a}^{80} \quad (6)$$

Multiplying these unemployment rates by the previously obtained labor force, $L_{ij.a}^{80}$, yields preliminary projections of the unemployed by race and sex, $\hat{U}_{ija}^{80}$.

$$\hat{U}_{ija}^{80} = \hat{UR}_{ija}^{80} \times L_{ij.a}^{80} \quad (7)$$

The final unemployment projections are obtained by forcing these numbers to sum to the independently provided local area control total.

3. Test of Projection Accuracy

With the release of Summary Tape File 4 (STF4) of the 1980 Census [U.S. Bureau of the Census, 1982a], it is now possible to evaluate the performance of the labor force and unemployment projections. Summary Tape Files 1 and 2 [U.S. Bureau of the Census, 1981a, 1982b] contain complete count data only and thus have no data on labor force status. Although Summary Tape File 3 [U.S. Bureau of the Census, 1982c] contains some data on labor force status, it does not contain the required cross-tabulation of labor force and unemployment by race (White, Black and Other), sex, and age ((16-19), (20-24), (25-34), (35-44), (45-64), and (65+)).

To test the assumption that changes at the local level can be approximated by changes at the national level and to show the amount of error introduced by the use of previously calculated projections, the following sets of projections were calculated and compared -

1) Labor Force Projections -
   a) With the 1980 population as projected from the 1970 Census,
   b) With the 1980 population as obtained from the 1980 Census, and
   c) With the 1980 population as obtained from the 1980 Census and with the national change factors, N_{ijk}, of equation (1) set to one.

2) Unemployment Projections -
   a) With the 1980 labor force as projected from the 1970 Census,
   b) With the 1980 labor force as obtained from the 1980 Census, and
   c) With the 1980 labor force as obtained from the 1980 Census and with the national change factors, C_{ij}, of equation (5) set to one.

Within each set, case (a) is based entirely on projections from the 1970 Census - only the control totals are 1980 Census data. Cases (b) and (c) use 1980 Census data in the place of any projections previously calculated and needed in the current set of projections. Case (c) does not try to estimate changes in labor force participation rates or in unemployment rates but assumes that the rates obtained from the last decennial census do not change. A comparison of cases (a) and (b) will show how much of the error is due to the methodology of the model and how much is due to the use of previously calculated projections. A comparison between cases (b) and (c) will show how much the use of the model reduces the error over using a change factor of one, i.e., keeping the 1970 distributions fixed.

To examine the performance of each projection model, several data items that had to be estimated when the models were originally calculated have been

replaced with actual data. First, the control totals needed in each set of projections are as determined by the 1980 Census rather than as had been estimated by a state planner. Second, in cases (a) and (b), the national changes in labor force participation rates and in unemployment rates are obtained by comparing the 1970 CPS annual averages with the 1980 CPS annual averages. Further work will have to be done to determine the errors due to the estimation of the national change factors. Third, the base year 1970 Census labor force participation rates and unemployment rates are *not* adjusted to yield annual averages; instead the actual 1970 Census rates were used. Since the projections are being compared with 1980 Census data and not with annual averages, the March/April 1970 rates should be updated and not the 1970 estimated annual averages.

To cover a wide range of geography, the projections were calculated for substate areas in Illinois, Massachusetts, New York, Ohio, Pennsylvania, and Washington, and for all states except Michigan[4]. The substate areas are the MSAs, county groups, the larger counties, and some cities. These particular states were chosen for the availability of data in the LBL model and to minimize the the impact of changes in racial self-identification from 1970 to 1980. As was stated in the Introduction, this model was designed to provide analysts in SESAs and SDAs with some of the data needed for their planning. The smaller states have just a few substate planning areas; only the larger states have enough population to contain 20 to 30 substate planning areas. Many substate areas were defined for Ohio, New York, and Washington since analysts in those states had requested that the model be run for all the counties within the state.

Due to changes in racial self-identification from 1970 to 1980, states with a sizeable Hispanic population were avoided. In 1980, 56 percent of the Spanish-origin persons nationwide were classified as 'White' and 40% as 'Other'; in 1970 however, 93% of the Spanish-origin persons were classified as 'White' and only 1% as 'Other' (U. S. Bureau of the Census, 1981b). Table 1 illustrates how this impacts the racial classification of the population in Nueces County, Texas. The difference column for the racial categories white, black and other is clearly comprised of more than births minus deaths plus migration. A large percentage of the increase of "others" is due to people who have changed the race with which they identify from White to Hispanic.

Clearly, a cohort component population projections model would not work in such a situation. The labor force and unemployment projections model under study would also fail due to the considerable shift in the underlying populations from White to Other. To minimize these racial changes, states with a large Hispanic population such as Florida, California, and Texas, were avoided. Other than New York City, most of the areas chosen are not greatly affected by the racial change from 1970 to 1980.

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[4]LBL received STF4 for Michigan several months after it had received and processed all the other states. It has not yet been installed in the Projections Model.

TABLE 1 -- Comparison of 1970 Census Population With 1980 Census Population

Nueces County Texas	1970 Population	1980 Population	Difference	Percent Difference
Total	237,544	268,215	30,671	12.9
White	225,425	220,219	-5,206	-2.3
Black	11,165	12,230	1,065	9.5
Other	954	35,766	34,812	3,649.1

Three measures of accuracy will be used to compare the three methods with the 1980 Census data. Since the geographic areas under study range in size from about 10,00 people to over 20,000,000 people, all the measures are based on a percent error. The percent, or relative, error is calculated as the estimated value minus the Census value, expressed as a percentage of the Census value. Specifically, the criteria to be used are -

1) Mean Absolute Percent Error -
The mean absolute percent error is the weighted mean of the percent errors disregarding sign. Minimizing the mean absolute percent error assigns equal weights to the relative errors of all places, large and small.

2) Extreme Relative Errors -
Extreme error is the percentage of relative errors exceeding a specified percent, 10 or 20%. A method that is apt to have several large or extreme errors may be useless in some applications. Not only should the mean error be low, but there should be only a few extreme errors.

3) Bias -
The bias is measured by comparing the number of areas whose estimates exceed the Census value with the number of areas whose estimates are less than the Census value. Ideally, half of the estimates should be too large and half should be too small.

3.1. Labor Force Projections

Table 2 summarizes the mean absolute percent errors, which are weighted by the total labor force of that area. Within each geographic area, the mean absolute percent error is the weighted average of the absolute value of the percent errors in each race, sex and age group.

A comparison of cases (a) and (b) in Table 2 shows that, overall, the mean absolute error is reduced by about a factor of two when the 1980 population projections are replaced with actual 1980 Census data; in Illinois, New York,

and Ohio, it is reduced by a factor of three! A comparison of cases (b) and (c) shows that the assumption that changes in labor force participation rates at the local level can be approximated by changes at the national level is valid and leads to lower levels of error than just applying the 1970 rates to the 1980 population. This is as expected due to the changing structure of the labor force during the seventies, and in particular, the increasing participation of females.

Table 2 - Mean Absolute Percent Error in the Labor Force Projections

Geographic Areas	Number of Areas	Mean Absolute Percent Error Case (a)	Case (b)	Case (c)
All States	50	6.5%	3.1%	12.1%
Illinois	40	9.3	2.9	11.2
Massachusetts	24	7.5	3.2	12.8
New York	82	10.3	3.7	12.3
Ohio	32	7.0	2.2	12.3
Pennsylvania	62	5.2	3.0	12.0
Washington	55	8.4	4.0	14.0
Average over 6 states	295	8.4%	3.2%	12.2%

It must be kept in mind, however, that the low errors of cases (a) and (b) are dependent on someone being able to forecast the total civilian labor force, almost two years in advance. Although the mean absolute percent errors are significantly lower in case (b) than in case (a), they are not bad in case (a) when the 1980 population projections are being used. These figures are particularly low considering that in each area the mean is calculated over 36 numbers - the two sexes by the three races by the six age groupings.

Table 3 shows how the relative errors vary with the size of each race, sex and age group. The first set of rows shows the results for race, sex and age groups of 25 or less in the labor force, ie., very small groups. Each successive set shows results for larger groups, ending with the last set giving the results for race, sex and age groups of 5,000 or more in the labor force. The number in parentheses in column one is the number of groups in each size range.

For very small groups, i.e., when the labor force by race, sex and age is less than 100, none of the three methods do very well. Approximately 75% of the errors are 20% or more in absolute value. Such groups usually occur for the racial group "black" or "other" in more rural areas. In these cases, the user should not try to project such small groups but should instead consider only two racial groups white and nonwhite, or not even use race as a factor.

When the size of the labor force is between 100 and 1,000, the magnitude of the errors has shrunk. Case (b) is a definite improvement over the other two cases and case (c) has a slight edge over case (a). Depending on the case,

between 24% and 65% of the errors are 20% or greater in absolute value. When the size of the labor force is over 1,000, case (b) is a definite improvement over case (a) and case (a) is also an improvement over case (c). As the size increases, the relative error for cases (a) and (b) decreases faster than does the relative error for case (c).

Table 3 - Distribution of Relative Error in the Labor Force Projections

Size of Labor Force Group	Size of Relative Error				
	<-20%	-20 to -10%	-10 to 10%	10 to 20%	>20%
<25 (2530)					
Case(a)	40	2	31	1	26
Case(b)	37	2	36	1	23
Case(c)	35	1	36	2	26
26-100 (1506)					
Case(a)	50	6	12	4	29
Case(b)	39	8	22	7	24
Case(c)	33	7	18	10	32
101-250 (1092)					
Case(a)	40	11	17	6	25
Case(b)	30	13	32	9	16
Case(c)	25	9	28	12	27
251-1,000 (1585)					
Case(a)	25	15	32	10	18
Case(b)	14	15	50	11	10
Case(c)	14	9	36	15	25
1,001-5,000 (1715)					
Case(a)	9	15	51	13	11
Case(b)	4	10	74	9	4
Case(c)	13	16	39	13	19
>5,000 (2192)					
Case(a)	4	11	69	12	5
Case(b)	1	4	92	3	1
Case(c)	14	14	48	16	7

For all except the smallest labor force groups, Table 3 shows that the relative errors are distributed symmetrically about zero. To look for the possibility of bias within a race, sex group, Table 4 shows the distribution of positive errors for each race, sex group in each state under study. For whites, the estimates appear to be unbiased in cases (a) and (b). These is a small negative bias for blacks of both sexes and a larger negative bias for others of both sexes. There is considerable bias for case (c), as males of all races are overestimated

and females of all races are underestimated.

Table 4 - Percentage with Positive Errors in the Labor Force Projections

Geographic Areas	Male White	Male Black	Male Other	Female White	Female Black	Female Other
Illinois						
Case (a)	52%	39%	30%	58%	43%	46%
Case (b)	56	39	33	53	52	42
Case (c)	93	74	63	27	47	42
Massachusetts						
Case (a)	58	36	38	62	42	48
Case (b)	48	33	39	63	32	54
Case (c)	94	67	64	33	39	52
New York						
Case (a)	54	43	35	55	44	34
Case (b)	55	42	42	51	45	40
Case (c)	88	72	67	31	42	40
Ohio						
Case (a)	58	44	29	49	40	45
Case (b)	62	41	38	47	46	44
Case (c)	94	83	68	28	44	45
Pennsylvania						
Case (a)	45	43	28	55	42	40
Case (b)	42	50	38	54	46	42
Case (c)	85	73	59	30	44	41
Washington						
Case (a)	56	31	27	49	40	21
Case (b)	58	32	33	51	39	20
Case (c)	88	58	61	30	34	20
50 states						
Case (a)	45	39	25	54	43	27
Case (b)	56	39	22	52	38	26
Case (c)	89	88	63	28	41	28

3.2. Unemployment Projections

Table 5 summarizes the mean absolute percent errors of the unemployment projections. This information corresponds to that presented for the labor force in Table 2. In each area, the mean absolute percent error is calculated by weighting the absolute value of the percent error in each race and sex group by the 1980 Census unemployment of that group. The mean for each row is calculated by weighting the mean in each area by the total unemployment of the

area.

Table 5 - Mean Absolute Percent Error in the Unemployment Projections

Geographic Areas	Number of Areas	Mean Absolute Percent Error Case (a)	Case (b)	Case (c)
All States	50	8.4%	8.0%	16.7%
Illinois	40	13.6	13.6	24.7
Massachusetts	24	4.9	5.2	12.8
New York	82	9.2	8.4	16.6
Ohio	32	13.0	12.9	22.3
Pennsylvania	62	7.6	7.7	15.4
Washington	55	8.1	9.0	14.6
Average over 6 states	295	9.9%	9.7%	18.3%

These results are quite different from those for the labor force projections. The mean absolute percent errors are larger for all three cases. Furthermore, case (b) shows no improvement over case (a). The second result is not that surprising. Section 3.1 showed that although the labor force projections were improved by using 1980 population data instead of 1980 population projections, the errors incurred using the 1980 population projections were not bad. Although the means are quite high, a comparison of cases (b) and (c) shows that using the national changes in unemployment rates is better than the alternative of keeping the 1970 distribution fixed.

Table 6 shows how the mean absolute percent errors vary with the size of the geographic area. This table corresponds to Table 3 for the labor force projections. Table 6 reinforces the results presented in Table 5 - the mean absolute percent errors are quite high and there is little difference whether the unemployment projections are based on 1980 labor force projections (Case a) or on 1980 Census labor force figures (Case b). Although the size of the error changes inversely with the size of the area, the improvement is not as dramatic as with the labor force projections. These errors are particularly large considering that the correct total number of unemployed is used as a control and only six numbers (two sex groups by three races) are being projected. There are at least four possible reasons.

1) One possible explanation is that the numbers involved are smaller than when projecting the labor force. In general the errors are larger when the numbers to be projected are smaller. However, when projecting the labor force by race, sex and age, 36 different groups are being calculated whereas in the unemployment only 6 race/sex groups are being calculated. In an area with about 8% unemployment, the average number in the labor force for each race/sex/age group is only about twice the

number of unemployed persons for each race/sex group. Thus, although the mean absolute percent error should be larger than in the labor force projections, the increase from 3.2% to 9.7% (Case b) can not be explained solely by the difference in size.

2) Another possible source of error is using annual changes in unemployment rates to update seasonal unemployment rates, ie., the March/April 1970 Census unemployment rates are being projected and compared to March/April 1980 Census unemployment rates. Using annual rates to update seasonal changes would cause problems if the seasonal factors changed from 1970 to 1980. The author doubts this is the case but does not have the data necessary to prove it.

Table 6 - Distribution of Relative Error in the Unemployment Projections

Size of Unemployment Cohort	Size of Relative Error				
	<-75%	-75 to -10%	-10 to 10%	10 to 75%	>75%
<25 (n=416)					
Case(a)	45	2	27	1	25
Case(b)	44	1	28	0	27
Case(c)	44	0	29	0	26
26-100 (n=288)					
Case(a)	51	3	8	3	34
Case(b)	44	5	8	5	37
Case(c)	49	6	12	2	31
101-250 (n=180)					
Case(a)	41	6	16	9	28
Case(b)	34	6	15	7	37
Case(c)	43	8	14	7	28
251-1,000 (n=275)					
Case(a)	23	9	32	7	28
Case(b)	22	8	29	12	30
Case(c)	29	11	21	11	28
1,001-5,000 (n=405)					
Case(a)	7	16	46	18	13
Case(b)	8	15	48	17	13
Case(c)	19	20	22	13	26
>5,000 (n=206)					
Case(a)	8	18	61	10	4
Case(b)	6	19	62	10	3
Case(c)	21	24	29	9	17

3) Another possible explanation is the changes in racial self-identification between the 1970 and 1980 Censuses. Although the areas chosen for study were intended to minimize this problem, it could still have some impact. In an area where there has been a considerable increase in the number of Spanish-origin persons from 1970 to 1980 due to changes in self-identification, the unemployment projections would be tend to overestimate the number of unemployed whites and would underestimate the number of unemployed others.

Table 7 - Percentage with Positive Errors in the Unemployment Projections

Geographic Areas	Male White	Male Black	Male Other	Female White	Female Black	Female Other
Illinois						
Case (a)	8%	45%	38%	95%	60%	50%
Case (b)	8	48	38	90	64	52
Case (c)	5	18	30	98	62	52
Massachusetts						
Case (a)	58	58	38	58	38	17
Case (b)	54	75	33	58	50	12
Case (c)	12	42	21	96	50	12
New York						
Case (a)	32	65	27	65	53	37
Case (b)	32	63	26	66	53	42
Case (c)	7	31	22	99	51	42
Ohio						
Case (a)	0	62	41	97	69	29
Case (b)	0	60	44	97	72	35
Case (c)	0	16	31	100	75	32
Pennsylvania						
Case (a)	34	57	31	61	28	28
Case (b)	44	56	43	56	28	26
Case (c)	18	31	28	82	28	26
Washington						
Case (a)	36	44	51	62	28	26
Case (b)	33	62	73	53	28	57
Case (c)	15	38	53	93	28	53
50 states						
Case (a)	34	50	46	82	48	20
Case (b)	26	48	54	68	54	36
Case (c)	6	12	38	98	56	38

Table 7 shows the percentage of positive errors in each of the geographical areas studied for all cases. If changes in racial self-identification were

biasing the results, most of the percent errors for whites would be positive and those for others would be negative. (For each area, the percent error is calculated as the projected value minus the census figure, divided by the census figure.) Table 7 does not show such a pattern. Although, the errors are largely positive for white females, they are largely negative for white males. The errors for blacks and others appear to be about half positive and half negative.

4) Another possible cause of error is the basic assumption on which the model depends, i.e., that local race/sex changes in unemployment can be approximated by national race/sex changes in unemployment. From Table 5, the comparison of case (b) with case (c) shows that the use of national changes yields better results than keeping the 1970 standardized rates fixed. However, due to the magnitude of the errors in both cases (a) and (b), the local changes is unemployment depend on more than just the national changes in unemployment.

   Evidence suggests that there is a considerable variation across the country in changes in unemployment rates by race and sex (U. S. Bureau of the Census, 1982a). Some of this change may be explained by the industries that are involved. For example, in states that were hard hit by unemployment in the automotive industry, with traditionally male occupations, one would expect more male unemployment than female unemployment. On the other hand, in areas largely dependent upon textile mills that traditionally hire females, cutbacks would hit females more than males.

   The data in Table 7 confirm this observation. All the estimates for white male unemployment in Ohio were too low. In 1980, Ohio was suffering from closures in the steel and automotive industries, both traditional sources of male employment. In Massachusetts, with a lot of finance and service industries and little heavy industry, the unemployment estimates for whites (Cases a and b) were not particularly biased one way or the other.

4. Summary

The labor force projections perform well, even for small areas, which suggests that changes in local labor force participation rates can be approximated by national changes. In fact, the mean absolute percent errors are low even when the previously calculated population projections are used.

The unemployment projections do not do as well. Using 1980 Census labor force data instead of previously calculated labor force projections offers no improvement in the results. A two step study should be made to determine why the errors are larger than expected. In the first step, the state level changes from 1970 to 1980 should be calculated and compared with the national changes in unemployment rates to determine how much variation there is in changes in

unemployment rates by race and sex. In the second step, state level data on the occupational mix should be obtained to see if there are correlations between the changes in state level unemployment rates by race and sex and the main occupations of the state.

It is hypothesized that step (1) will show that even state level changes in unemployment rates by race and sex can not be well approximated by the national changes and that step (2) will show that some of this variation can be explained by differences in the occupational mix over the states.

Further studies should be made to determine how the calculation of national changes affects the results. Since changes in labor force participation rates seem to follow trends, the necessary extrapolation may not affect the results considerably. Using the actual changes in unemployment from 1970 to the latest year available as a proxy for the changes from 1970 to the target year could have a serious detrimental affect for the unemployment projections. However, if some of the variation in the national changes in race and sex can be explained and some adjustments could be made, using the actual changes as a proxy for the desired changes may be sufficient.

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