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LABOR FORCE COMPOSITION AND UNDEREMPLOYMENT TRENDS, 1969–1980*

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ABSTRACT. Underemployment indicators are both 'objective' indicators of individual well-being and social welfare and 'normative' indicators for programmatic use. Components of an underemployment indicator framework, the Labor Utilization Framework (LUF), are operationally defined and shown to be closely related to a family of proposed alternatives. Using CPS data, a 12-year time series of LUF indicators is developed for the U.S. labor force and its key subgroups. The across-time heterogeneity of the labor force is analyzed in relation to a 'basic' demographic group-by-LUF-by-time contingency, showing how the complexity of labor force structure that emerges from a multi-state indicator of underemployment can be rigorously modeled. Standard log-linear models, which focus on the temporal aspects of data from repeated cross-sectional surveys, provide the analytic technique. Changes in the demographic composition of the labor force account for about 30% of the overall period variability, and age structure has made the most important contribution to the compositional change.

Current unemployment rates, which threaten to reach new record levels, signal hard times not only for workers actively seeking jobs, but also for employed workers whose jobs are downgraded during recessions. It is particularly striking that conventional labor force statistics conceal the magnitude and composition of the 'subemployed' or 'underemployed' population through the stages of the business cycle. No one denies the usefulness of labor force statistics as a generator of economic indicators, especially in comparison with the older 'gainful worker' approach (Hauser, 1949). Nevertheless, the labor force approach and its derivative indicators, the labor force participation rate and the unemployment rate, ignore workers who are marginally employed. Recent measures that emphasize changes in the numbers employed share this defect (Shiskin, 1976).

As Biderman and Drury (1976, p. xviii) predicted, however, hard economic times reduce the momentum of the social indicators movement – including the development of underemployment indicators. The scarcity of underemployment indicators does not reflect a lack of interest, for efforts to conceptualize and measure underemployment predate the current social indicators movement. At least since the Great Depression of the 1930s, the

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detrimental effect of inferior employment on individual and social welfare has been recognized (Robinson, 1936). Three decades of conceptual work have led to a substantial consensus that 'underemployment' manifests itself in a small set of symptoms (ILO, 1957, 1966, 1976; a detailed historical treatment appears in Sullivan, 1978, pp. 3–13 and pp. 24–44), These symptoms include involuntary part-time work, 'working poverty', the gross misfit between educational credentials and employment opportunities, and 'discouragement'. ('Discouraged' workers are not counted in conventional labor force measures because they have ceased the active search for work.)

The term 'underemployment', referring to one or more of these conditions, is rapidly passing into common usage (e.g., see Feagin, 1982, pp. 81 85; Solmon *et al.*, 1981). Moreover, the potential use of underemployment measures in policy making has also been recognized. In 1973 Congress mandated the Secretary of Labor to establish a data series on 'labor-market related hardship' (Pub. L. No. 93–203, 1973, S.302 (b), (c)), and in 1976 Congress charged the National Commission on Employment and Unemployment Statistics to consider data relating to 'hardship' and the 'underemployed' (Pub. L. 94–444, 1976, S.13 (d)). Two successive national commissions on employment statistics have recommended the development and publication of indicators of 'underemployment' (President's Committee, 1962) or 'labor market related economic hardship' (NCEUS, 1979, p. 60).

Despite widespread adoption of the term underemployment and the Congressional mandate to develop the data series, research on underemployment indicators has languished. Aside from political or ideological reasons for postponing their development, two technical issues have required resolution. First, there has been disagreement about the proper way to operationalize the measurement of the symptoms of underemployment. Secondly, some researchers have wrongly concluded that it is necessary to use a composite underemployment index (e.g., NCEUS, 1979, pp. 77–79), perhaps because only recently have techniques been developed for the adequate analysis of multi-state indicators.

Both of these problems are addressed in this paper, which develops and applies a framework of 'underemployment' measures to supplement conventional labor force measures. This framework, referred to as the Labor Utilization Framework (LUF), has previously been applied to U.S. Census data (Sullivan, 1978), to U.S. Current Population Survey data (Clogg, 1979), and to data from several developing nations (Hauser, 1974, 1977; Ring,

1978). Here it is applied to a twelve-year time series (1969–1980) taken from the U.S. Current Population Survey (CPS), the most extensive application of the framework so far. In this framework, 'adequate employment' rather than 'employment' is the residual quantity. Similar measures proposed in the literature are shown to be special cases of LUF easily derived from the LUF operational procedures. In addition, this paper indicates how standard log-linear models can be used to model temporal changes in a multi-state indicator, and it shows how LUF might be used in the analyses so characteristic of social indicator research. A substantive application of these techniques is made by analyzing the effects of demographic composition on underemployment. In concluding comments, we argue that LUF is both an 'objective social indicator, suitable for the quantitative study of social change, and a 'normative' social indicator, suitable for programmatic response to social and economic priorities.

I. THE LABOR UTILIZATION FRAMEWORK: DATA AND OPERATIONAL PROCEDURES

The Current Population Survey, source of monthly indicators of unemployment and labor force participation, is especially suited to LUF, a series of indicators that is closely related to the standard labor force approach. This section provides simplified operational procedures for deriving LUF from CPS data. These procedures represent a considerable improvement over the complicated and sometimes clumsy procedures used in both Sullivan (1978) and Clogg (1979). The Appendix documents the close congruence of results from the simplified procedures with the results obtained by Sullivan and Clogg.

There are six LUF components: S (subunemployment), a proxy for discouraged workers; U (unemployment), an indicator which is already widely used; H (hours of work), an indicator of involuntary part-time work; I (low income), which refers to full-time workers whose *work-related* income is below some societally-accepted minimum; M (mismatch), which is gross overeducation relative to that typically possessed by others in similar occupations; and A (adequate employment), a residual designation for those who are employed but not in any of the preceding categories. The labor force, as usually defined (U.S. Census, 1978), is the sum of persons in categories U, H, I, M, and A. We refer to the sum of S, U, H, I, M, and A as the modified

labor force (MLF), and some of our analysis will be based on this more inclusive definition of economic activity.

Ideally, the S component should be composed of 'discouraged workers' (see Flaim, 1973; Finegan, 1979). The March CPS does not ask all persons not in the labor force why they were not currently looking for work. However, two questions that are close proxies are asked. The first question pertains to the main reasons for not working during the past year. An individual who is not *currently* a member of the labor force, and whose reason for not working last year was 'unable to find work', is similar to the discouraged worker. Commencing in 1976, this question was changed slightly, but it still apparently referred to the same individuals. (We could find no empirical differences in the results.) The second question asks part-year workers for the main reasons for part-year work. If the individual is not currently in the labor force and responds that he or she has been 'looking' (for full-year work), this person is also similar to the discouraged worker. Taken together, the designated responses to these two CPS questions provide a reasonable proxy for the discouraged worker phenomenon.

Unemployment (U) refers to respons who have no employment but are available for work and (a) had engaged in specific types of jobseeking activity within the last month, or (b) were waiting to be called back to a job from which they had been laid off, or were anticipating taking a new job within the next 30 days. This is merely the standard definition of unemployment. It is obtained by elementary manipulation of the 'employment status' variable, derived from a routine question is censuses, labor force surveys, and other sample surveys. As shown below, the definition of the U component could be accommodated to alternative definitions of unemployment that have been suggested.

The H actegory is equivalent to the 'part-time unemployed' or 'part-time for economic reasons' category already in widespread use. The U.S. Census Bureau uses the 35 hour work week as a criterion for determining part-time work. Workers who spent less than 35 hours on the job in the past week, and listed 'economic reasons' for part-time work are included in this category. Economic reasons include 'slack work, material shortages, repairs to plant or equipment, start or termination of job during the week, and inability to find full-time work'. This definition of the H component is identical to that used in earlier work.

The low income (I) category measures the prevalence of work that does

not produce adequate income for the individual worker. This component is concerned solely with labor market-related income, even though transfer payments or welfare subsidies may result in a substantially larger total household income. We calculated work-related income for individuals for the previous year (this is the only income information available on the CPS, as well as on most surveys relevant to labor force measurement). Then we compared this figure with a quantity equal to 1.25 times the Poverty Threshold for an individual. The Poverty Threshold (PT = $1877 in 1968, $3918 in 1979) is based on a Social Security Administration definition (see, e.g., U.S. Bureau of the Census, 1980a, p. 205). Full-time workers falling below this level were categorized as underutilized by low income.

Mismatch (M) refers to the phenomenon of having too much education for the occupation in which the individual is currently employed. Criteria identical in most respects to those used by Sullivan (1978) were utilized. Her approach first reclassified 3-digit occupation categories into groups that are essentially homogeneous with respect to educational attainment. Then the mean years of schooling for all individuals in these occupational groups in 1970 was calculated. Finally, a figure of the mean plus one standard deviation was used as a cut-off point: all individuals in a particular occupation, who had more schooling than the 1970 mean plus one standard deviation, were classified as mismatched. The *same* criterion was used for all years of the study, implying that the trend in mismatch could be reliably gauged, even if the *absolute* level for any particular year could be in some instances treated as an artifact of our original definition. Adjustments were made for the 1969 and 1970 CPS files, which were based on the 1960 Census occupation classification. The Appendix presents SPSS control cards that can be used to determine mismatch, based on the 1970 census occupation classification. Researchers interested in applying LUF to non-U.S. settings should consult Sullivan (1978) for guidelines on how to measure the M component.

Adequate employment (A) is the complement of underemployment; a worker is said to be adequately employed if he/she experiences no underemployment.

The Appendix provides further justification for efforts to simplify the measurement of LUF. Empirical comparisons of results from these procedures with the results of earlier procedures show no important differences, and the measurements presented here may be easily adopted by other researchers.

Two important technical characteristics of this approach should be noted. First, LUF relies exclusively on person-level information on employment status, income received from work, occupation, and the like. No reference is made to household or family characteristics when determining the underemployment status of individuals within households. Implicit in this set of definitions is the assumption that *labor market* 'hardship', or 'under-utilization' should be assessed on a per-worker basis, without a priori consideration of intrahousehold decisions respecting labor supply. Compared with the procedures used by Sullivan (1978) and Clogg (1979), these procedures provide a closer approximation of the prevalence of underemployment among individuals, while yielding results that are empirically equivalent (see Appendix). Research principally interested in family or household welfare should cross-tabulate LUF measures by the appropriate variables. Secondly, categorical-type definitions have been used in operationalizing LUF. Categorical or 'state' variables seem preferable, even though at the conceptual level some of the variables are continuous or nearly so, in order that *prevalence* measures can be easily determined. Prevalence measures are probably of most use to policy makers. Unlike some related measures that we discuss in the next section, LUF indicators can be inexpensively calculated on a regular basis from data already collected.

II. THE GENERALITY OF LUF

A variety of techniques for measuring underemployment have been proposed in the literature, most of which have been extensively compared with LUF (Sullivan, 1978; Sullivan and Hauser, 1979). From a social indicators perspective, these alternatives may be arrayed along two continua: currency and comprehensiveness. The *currency* of measures refers to their ability to report the prevalence of underemployment on a regular basis. *Comprehensiveness* refers to ability to report the multiple symptoms of underemployment for the entire labor force. LUF is both current and the most comprehensive of the proposed measures; moreover, the less comprehensive measures may be considered special cases of LUF.

1. *Currency of Measurement*

Contemporary labor force measurement is designed to provide a cross-sec-

tional 'snapshot' of labor force behavior during a specified period. Older techniques that refer to 'usual' or 'customary' occupational status during an indefinite period do not provide current data on labor force size and composition, and so they cannot chart short-term changes in the labor force. By the same token, underemployment indicators need to provide periodic measures of the prevalence of underemployment.

Two classes of proposed measures do not provide current measures. First, there are measures based upon hypothetical quantities – for example, the number of workers who *would* be released for other work *if* certain forms of technology were introduced. Such measures, discussed by Myrdal (1968), Smith (1971), and Turnham (1971), provide detail on neither the composition of underemployment nor on its changes.

Secondly, there are quantifications of aspects of underemployment based upon the statistical analysis of occasional surveys. For example, the rate of return to education, which is conceptually related to mismatch, can be measured as a regression coefficient (Freeman, 1976). In the discussion of results that follows, we compare some such studies to LUF. However, a time-series of regression coefficients poses substantial problems of interpretation. Such measures, while useful for many purposes, do not provide regular measures of the prevalence and composition of underemployment.

In contrast, techniques that modify the usual labor force statistics generally provide current information. Two defects typically prevent these measures from achieving full currency. The first defect is the *a priori* exclusion of some members of the current labor force from all aspects of underemployment measurement. These exclusions are based on very strong assumptions about, for example, whether elderly workers or married women can experience underemployment. The resulting measures are somewhat difficult to generalize because of the ambiguous universe.

The second defect is flawed time referents. Both critics (Horvath, 1980) and proponents (Sullivan, 1978, p. 42) of underemployment measures point out that the usual time referent of the preceding week (for employment) or four weeks (for unemployment) is too short for estimating income adequacy. Income for the previous year is the variable that most reliably approximates current income. By the same token, as explained in the preceding section, the measurement of worker 'discouragement' requires reference to the preceding year. However, these flaws arise from operational anomalies rather than deviations from the concept of currency.

'Currency' is conceptually a continuum. In terms of producing periodic measures of the prevalence of underemployment, LUF approximates the 'currency' criterion more closely than do several proposed alternatives; its defects from the currency criterion are shared by all data on income and labor supply.[1]

2. *Comprehensiveness of Measurement*

Proposed measures of underemployment may be classified as more or less comprehensive depending upon coverage of symptomatic components of underemployment and the coverage of the labor force. LUF can be shown to be very comprehensive, and the less comprehensive measures can be easily derived from the LUF format.

The least comprehensive measures of underemployment are the one-component measures. Berg's (1970) informal indicators of mistatch, approximated by our M, are one example. The one-component measure of discouraged workers discussed by Flaim (1973) and Finegan (1979) can be obtained with only slight modification of our S component. The standard unemployment rate is another example.

The U.S. Bureau of Labor Statistics actually employs several different definition that we have adopted in our U component. U_1 refers to persons 1979, p. 35). These are referred to as U_1–U_7; U_5 denotes the standard definition that we have adopted in our U component. U_1 regers to persons unemployed 15 weeks or longer as a percent of the civilian labor force. U_2 refers to job losers (ignoring lay-offs, new job seekers, etc.) as a percent of the civilian labor force. U_3 refers to unemployed persons 25 and over as a percent of the labor force 25 and over. U_4 refers to unemployed full-time job seekers as a percent of the full-time labor force (ignoring the part-time labor force, and ignoring those who are seeking only part-time work). U_5 is the official unemployment rate, equal to our U component.

U_6 and U_7 are examples of multi-component measures. U_6 is defined as a full-time job seekers plus one-half of the part-time job seekers plus one-half of the part-time unemployed (our H component), all expressed as a percentage of the civilian labor force with one-half of the part-time labor force deleted. U_7 is variously defined, but the main idea of this measure is the inclusion of a third component, discouraged workers (approximated by our S component), in the numerator of U_6, with corresponding modification of

the denominator. From these definitions it is evident that the LUF components could be manipulated to produce the U_1–U_7 measures. To effect such a reconciliation, all that is required is adjustment of the definition of the U category of our LUF scheme, inclusion or omission of the S category, and entering the H component with some proportionality constant. (To get U_3, of course one would have to restrict the age ranges to which the measures apply, with a corresponding loss of comprehensiveness.)

To see what effect these different definitions of unemployment have, it is useful to examine them in a concrete situation. For the *first quarter* of 1979, U_1 = 1.2 percent, U_2 = 2.4 percent, U_3 = 3.9 percent, U_4 = 5.2 percent, U_5 (the standard) = 5.7 percent, U_6 = 7.2 percent, U_7 = 7.9 percent. The U component in the LUF scheme could be adjusted in a way consistent with any of these definitions, and it should be noted that the other components could be redefined – and their absolute magnitudes changed in the process – by using similar types of redefinition. However, the reporting of a single magnitude loses much of the information a multi-component measure can produce.

Another two-component measure, used by Kemp and Beck (1981), is the unemployed and the involuntary part-time worker. This is a straightforward combination of the U and H components that has been extant in the literature for a number of years (e.g., Hodge and Wetzel, 1967) and is easier to interpret than U_6. Nevertheless, Kemp and Beck (1981, p. 252) note the desirability of including more components.

Wirtz (1972) presented a four-component index, three components of which correspond to our S, U, and H components. The fourth, based on strong assumptions about the relationship of underemployment to the census undercount, adds in 50% of the estimated undercount. LUF contains nothing analogous to this component. Sample data can be weighted making allowance for the undercount, but there is no basis for assuming differential underemployment of the uncounted. (Indeed, there are sketchy and unsystematic data that suggest an assumption of equivalent underemployment is more appropriate [Klein, 1970].)

Other four-component measures have been developed by Spring *et al.* (1972), Levitan and Taggart (1973, 1974), Miller (1973), Vietorisz *et al.* (1975), and Gordon (1977). Although these measures have slightly different objectives and operational definitions of the components, they are quite similar in being combinations of what we call the S, U, H, and I components.

None of these measures include mismatch, although several allude to its desirability (Vietorisz *et al.*, (1975), pp. 9–10). Each measures varies somewhat in the universe to which it can be generalized because some portions of the labor force are excluded.

LUF is essentially a more general case of these indicators. Its objective, to measure labor force underemployment, is the most general, and it is the only one that includes mismatch. Its universe is the entire labor force plus discouraged workers. However, LUF can easily be modified to report the less comprehensive and more specialized measures.

Despite the extra information offered by comprehensive measures, however, there has been concern about the ordering of the components and the combination of the components into a single index. The LUF components are 'ordered' to classify workers into mutually exclusive statuses. Hauser (1974, 1977) suggested ordering the components S–U–H–I–M–A, with the result that workers would be counted as mistmatched only if they experienced no other type of underemployment. The statistical basis for this type of ordering arrangement is very similar to a Guttman scaling procedure (see Clogg and Sawyer, 1981), and statistical analyses of the LUF components justify the ordering Hauser originally proposed. In the following text, the LUF components are considered in this order. If one suspects a nontrivial loss of information by applying Hauser's rule, then one can (a) study the LUF components separately, or (b) expand the categories recognized in the LUF classification (see Table XI in the Appendix).

A related issue is the reporting of the components in a composite index. There are two forms of this issue. First, some composite indices cannot be reported for subgroups of the labor force (for example, see Smith, 1971, pp. 63–65). Secondly, some composite indices cannot distinguish the components of underemployment, often because all underemployment is reported through one indicator – for example, income. (See Jones, 1971, p. 520, for an example. This problem also applies to regression-based strategies using income as the dependent variable.)

A variation of this second argument has been made, we believe improperly, against the multi-component measures. These measures, it is argued, must be reported as a composite index that improperly gives equal weight to each form of underemployment and is difficult to understand (NCEUS, pp. 77–79). The justification given for a composite underemployment rate is that it indicates the number of *persons* affected by underemployment (Sullivan,

1978, p. 43), and this justification is not addressed by the critics (e.g., Horvath, 1980). Moreover, composite indexes such as U_6 and U_7 do not seem to confuse the public.

More importantly, however, this argument is fundamentally misguided in its assumption that only a composite index can result from frameworks such as LUF. This assumption, in turn, stems from unfamiliarity with procedures for analyzing multi-state indicators. We demonstrate such techniques below. Indicators developed from LUF can not only be disaggregated by population group, but they can also be reported separately by component.

In summary, LUF is a current and comprehensive measure of underemployment that can be adapted for the specialized purposes of proposed alternative measures. Such measures are now reported for the 1969–1980 period.

III. THE RECORD OF ANNUAL CHANGES IN U.S. UNDEREMPLOYMENT COMPONENTS, 1969–1980

The operational procedures previously described were applied to the March Current Population Survey (Annual Demographic File), for years 1969–1980. Definitions of S, U, and H components were exactly as discussed earlier. The I component was defined in relation to the individual-level Poverty Threshold income figure for the previous year (because income reported in the March CPS pertains to the income experience of the preceding calendar year), using the '1.25 × PT' rule that is discussed in the Appendix. The Poverty Thresholds were obtained from documents published by the Bureau of Labor Statistics for every year except 1980. The 1980 Poverty Threshold was obtained by applying the Consumer Price Index (U.S. Department of Commerce, 1981, pp. 5–6) to the 1979 figure. To define the M (mismatch) component, the education and occupation criteria developed for the benchmark of 1970 were applied uniformly to all years. While we might be skeptical about the actual absolute magnitudes of the M mismatch rates, there should be little question about the ability of the strategy to isolate broad trends in the prevalence of mismatch, as inspection of the results shows.

Table I presents the prevalence of the several LUF components as a percentage of the MLF (modified labor force). By our definitions, the proportion of the economically active population with adequate employment declined from 77.0 percent in 1969 to 67.4 percent in 1980, a decline of almost 10 percent. The most salient trend in the data pertains to the

prevalence of mismatch, which increased absolutely from 7.8 percent in 1969 to 14.2 percent of 1980. Expressed in different terms, this is an 80 percent increase in mismatch, or an average increase of 0.6 percent per annum. (Note that this was the annual shift that was anticipated in Clogg, 1979, pp. 30–33.) Applied to a labor force total that averaged about 100 million over the interval, these figures correspond to an increase of over 6 million mismatched persons. Regardless of the crudity of measurement, it seems unmistakably clear that there has been a sustained and dramatic increase in the prevalence of mismatch. This finding supports Freeman's (1976) conclusion that there has been over-education relative to the occupational demand for educated labor, and supports it with a more inclusive population universe. It is inconsistent with the alternative explanation by Featherman and Hauser (1978) that there is only apparent 'decline' in occupational return to college education.[2]

Some critics charge that mismatch is confounded with educational attainment, arguing that mismatch has to rise as educational attainment rises (Keyfitz, 1981). On the contrary, mismatch does not have to rise as educational attainment rises; it is only if the occupational structure is not accommodating increases in education (or vice versa) that the framework would result in a recorded increase in mismatch. The mismatch component of the LUF scheme is more suited to policy and programmatic discussion of the over-education phenomenon than are 'occupational status' or 'income attainment' models. LUF leads directly to a measure of *prevalence*, not a regression coefficient usually calculated on a single cross-sectional or retrospective survey of occupational origins and destinations. For example, the Featherman–Hauser study focuses on data that were collected in 1973; Table I indicates low unemployment in that year, and a 4.1 percent increase in mismatch since then. Their study measures 'returns' to education which resulted from the process of attainment in the period 1940–1973, the LUF measure, on the other hand, provides period-specific prevalence measures.

While M indicates a strong secular trend, other components are closely attuned to the business cycle. The S, U, and H measures exhibit the sort of variability that is apparently associated with labor market exigencies, as we currently conceive of them, with increases noted during recessions (e.g., 1975, 1976). The I component appears to stay close to 7 percent over the whole range of the study. It dipped below this, to nearly 6 percent, in 1977, but part of the reason for his low figures was the fact that some low-income workers were transferred into the unemployed and low-hours categories in

TABLE I

LUF components for 1969–1980, aggregate figures[a]

Year	S[b]	U	H	I	M	A
1969	1.2%	3.4	2.4	8.2	7.8	77.0[c]
1970	1.1	4.5	2.6	7.4	7.9	76.5
1971	1.5	6.1	3.0	6.9	8.7	73.8
1972	1.7	6.0	2.9	7.1	9.3	73.0
1973	1.5	5.1	2.5	6.9	10.1	73.9
1974	1.4	5.2	2.9	7.1	10.9	72.5
1975	1.7	9.0	4.2	6.6	11.0	67.5
1976	1.8	8.0	3.6	6.9	11.7	68.0
1977	1.7	7.8	3.6	6.3	12.5	68.1
1978	1.4	6.5	3.4	7.1	13.1	68.5
1979	1.1	6.0	3.3	7.1	13.9	68.6
1980	1.2	6.5	3.4	7.3	14.2	67.4

[a] The base (denominator) includes the 'subunemployed', our proxy for discouraged workers. The usual labor force definition excludes these persons.
[b] The mnemonics for the LUF components are as follows: S = subunemployment, U = unemployment, H = low hours, I = low income, M = mismatch, A = adequate.
[c] Total percent may not equal 100.0 due to rounding.
Source: see text.

TABLE II

LUF components by sex, selected years

Year	Sex	S	U	H	I	M	A
1969	male	0.7%	2.9	2.1	5.6	9.3	79.4
	female	1.9	4.2	3.0	12.5	5.4	73.0
	f/m[a]	2.7	1.4	1.4	2.2	0.6	0.92
1972	male	1.2	5.8	2.5	4.9	11.2	74.4
	female	2.4	6.4	3.4	10.6	6.4	70.8
	f/m	2.0	1.1	1.4	2.2	0.6	0.95
1975	male	1.1	8.9	3.6	4.6	13.2	68.6
	female	2.6	9.3	5.2	9.4	7.6	65.9
	f/m	2.4	1.0	1.4	2.0	0.6	0.96
1978	male	0.8	6.2	2.8	4.9	15.8	69.5
	female	2.3	6.9	4.2	10.2	9.3	67.1
	f/m	2.9	1.1	1.5	2.1	0.6	0.97
1980	male	0.6	6.6	3.1	5.2	17.0	67.7
	female	2.0	6.5	3.9	10.2	10.5	66.9
	f/m	3.3	1.0	1.3	2.0	0.6	0.99

[a] Female rate divided by male rate.
Source: see text.

this year. Table I does *not* document changes in 'poverty status' of households or persons because the definition of the I component is specifically related to earnings acquired in the labor market, not total household income (which includes various welfare subsidies).

The data in Table I might be condensed in several ways without serious loss of information. One approach would be to combine the S, U, H, and I component into a single 'economic underemployment' category, retaining the M component as a separate category. When this is done with the data in Table I, for example, full employment (1969) is associated with 15.2 percent 'economic underemployment' and 7.8 percent mismatch; the recession year 1975 is associated with 21.5 percent economic underemployment and 11.0 percent mismatch; and the last year (1980) records 18.4 percent economic underemployment. The difference between recession and full employment for the periods considered here is 5.9 percent, or in terms of a U.S. labor force of approximately 100 million, 6 million workers who shift 'downward' during recessions. The picture of labor force structure and trend, and the implications for programmatic response, are radically different when the data of Table I are used in place of the U component alone.

1. *Trends by Sex*

Underemployment varies considerably by sex, age, and color, as well as by other factors, and an essential aspect of social indicator analysis of this new framework is to compare the demographic groups by LUF components. There are many other types of contingencies that could be constructed immediately, but a logically prior empirical activity is to isolate the way that age, color, and sex are associated with different levels of underemployment.

Table II presents the LUF components by sex for selected years of the study. In a period with dramatic changes in the sex composition of the labor force, it is remarkable that the ratio of the female rates to the male rates remained virtually stable over the entire interval. The mismatch rate of females remained at about 60 percent the level of that for males; the low-income rate for females was about double the rate for males. Perhaps the only substantively interesting change in the ratios of male to female rates was the variability in the S component in which female/male ratios reached a low of 2.0 in 1972 and a high of 3.3 in 1980. This indicates the increasing

relative prevalence for females of 'marginality' to the economically active population. Despite substantial increases in women's labor force participation, the conventional labor force participation rate appears to underestimate the labor supply. However, for women in the active labor force, the essential stability in male/female differences *over a 12-year interval* indicates stability in the sex-underemployment relationship over time.

2. *Trends by Age*

Table III presents LUF components by age for selected years. One charge that has been made in connection with LUF is that mismatch is only a pertinent concept for the youthful members of the labor force. In 1969 mismatch is indeed the highest in ages 20–34 (9.1 percent), but it is nearly as high (7.1 percent) in ages 50–64. In 1980, it has increased 195% for ages 20–34 (17.7 percent), but it also increased 170% for the oldest primary working age group (50–64), for whom mismatch is 12.1 percent. Using the *same* definition of mismatch for 1969 as for 1980, it is evident that the 50–64 groups has much higher mismatch in 1980 than the 20–34 group in 1969. It must be noted that this is not a 'cohort' phenomenon, because those aged 20–34 in 1969 were only 31–45 in 1980, or mainly in the middle age category. Neither can it be due to increased educational attainment: those aged 50–64 in 1980 completed their schooling prior to the periods involved in this study. Although previous studies have indicated substantial downward occupational mobility among some older workers (Leigh, 1978, p. 81), the M indicator provides a less cumbersome and more systematic record of the trend.

The age differentials in the other LUF components show how the rewards of the labor market are distributed by age, or how underemployment varies in a U-shaped manner for all of the components, except mismatch. It is the very young (16–19) who bear the greatest burden with respect to the S and U forms; they are similar to workers 65 and over with respect to the H form. The I form is very high among youth and even higher among the old workers. The age group 20–34, while having the highest mismatch rates, also has very high rates of unemployment, part-time unemployment, and the like. The 20–34 age group suffers much difficulty in acquiring the main rewards of the labor market; a full or part-time job (S, U, H), adequate income (I), and skill utilization (M). Around 37 percent of the persons in this age group are underemployed in both 1975 and 1980.

TABLE III

LUF components by age, selected years

Year	Age	S	U	H	I	M	A
1969	16–19	3.5%	11.7	2.7	12.2	0.7	69.2
	20–34	1.2	3.8	2.3	7.3	9.1	76.3
	35–49	0.7	2.1	2.1	6.1	9.1	79.9
	50–64	0.9	2.1	2.6	8.1	7.1	79.2
	65+	2.3	2.4	3.5	25.2	4.8	61.8
1975	16–19	3.9	20.1	4.9	9.9	0.9	60.3
	20–34	1.8	10.3	4.6	6.1	14.3	62.4
	35–49	0.9	6.2	3.7	5.0	12.1	72.1
	50–64	1.3	5.6	4.1	6.3	8.5	74.2
	65+	3.7	4.7	3.8	17.2	5.3	65.3
1980	16–19	3.1	16.1	4.5	11.8	0.8	63.7
	20–34	1.2	7.8	3.8	6.7	17.7	62.8
	35–49	0.8	4.1	2.9	5.8	15.5	70.9
	50–64	0.8	3.5	3.0	7.1	12.1	73.5
	65+	2.4	2.7	3.8	17.7	4.8	68.7

Source: see text.

TABLE IV

LUF components by color, selected years

Year	Color	S	U	H	I	M	A
1969	nonblack	1.0%	3.1	2.1	7.4	8.1	78.3
	black	2.6	6.2	4.9	15.2	5.7	65.4
	b/nb[a]	2.6	2.0	2.3	2.1	0.7	0.84
1972	nonblack	1.5	5.5	2.7	6.6	9.6	74.1
	black	3.4	10.4	4.8	11.4	6.8	63.2
	b/nb	2.3	1.9	1.8	1.7	0.7	0.85
1975	nonblack	1.5	8.3	4.0	6.2	11.3	68.7
	black	3.9	15.2	6.8	9.7	8.2	56.2
	b/nb	2.6	1.8	1.7	1.6	0.5	0.82
1978	nonblack	1.1	5.8	3.1	6.9	13.2	69.9
	black	4.0	12.9	5.8	9.1	11.5	56.9
	b/nb	3.6	2.2	1.9	1.3	0.9	0.81
1980	nonblack	0.9	5.9	3.2	7.0	14.4	68.5
	black	3.5	12.3	5.4	9.5	11.8	57.5
	b/nb	3.9	2.1	1.7	1.4	0.8	0.84

[a] Black rate divided by nonblack rate.
Source: see text.

3. *Trends by Color*

Table IV presents the LUF components by color, where color is defined as black versus nonblack, with the ratios of black to nonblack rates. The currently available labor force indicators have yielded two generalizations about blacks that are repeatedly made in the literature (e.g., see U.S. Census; 1980b, pp. 60 61). The first is that black labor force participation rates now closely approximate those of whites, although there has been a persistent recent decline in the participation rates of black males. The second is that since World War II there has been a nearly constant two-to-one ratio between black unemployment rates and the unemployment rates for whites. Table IV indicates the poverty of these conclusions compared to the expanded information available through LUF.

Table IV confirms that the ratio for U remains very close to 2 throughout the twelve year period. However, there is a noticeable deterioration in the black/nonblack ratio for the S indicator, showing a relatively greater growth in 'discouraged workers' among blacks. The growth of discouraged workers may help explain the declining participation rates, especially among black men.

On the other hand, there is a modest decline in the black/nonblack ratio for the H and I measures. Mismatch shows some trend toward 'parity' between blacks and nonblacks, indicating greater educational attainment of blacks and perhaps also greater difficulties for educated blacks in receiving occupational regards commensurate with their educational attainment. The A (adequate employment) ratios maintain a nearly constant ratio over time, but inspection of the various forms of underemployment shows that offsetting trends have canceled each other out in the summary figure. Thus, there is a divergence in the black labor force; blacks who manage to avoid subunemployment or unemployment apparently are doing better in relation to their nonblack counterparts compared to a decade ago. This may be taken as empirical evidence in partial support of Wilson's (1980) thesis on the declining 'significance' of race.

As this discussion suggests, the labor force structure of demographic groups may be more fully analyzed when the full detail of the LUF indicators are admitted into the analysis. Conclusions about the black labor force based solely on the conventional indicators must be refined in light of the additional information in Table IV.

IV. THE RELATIVE EFFECTS OF DEMOGRAPHIC AND OTHER TEMPORAL CHANGES ON AGGREGATE UNDEREMPLOYMENT

The application of LUF is based on the analysis of repeated cross-sectional surveys. Such data have been suggested as an efficient means of studying change in social indicators like LUF (see Duncan, 1969), but special methods for analyzing the across-time heterogeneity in the LUF components are required. The LUF variable is inherently qualitative, producing a 6-fold categorization of the work force. Some methods could be applied to assign plausible scores to the categories to obtain an ostensibly quantitative variable. But there are good reasons for analytic methods that do not require the assumptions necessary to construct such scores. Moreover, even if defensible interval-level scores could be assigned to the LUF categories, there would still be the problem of having a discrete variable for analysis, one that would not lend itself easily to conventional analysis using regression techniques. It is perhaps the sheer complexity of the LUF components – producing six distinct categories as a 'response' variable – that has retarded its acceptance in social indicators research. Such complex polytomies, when considered in meaningful multi-way contingencies, have been unwieldy for most researchers to analyze. This section applies standard log-linear models (Goodman, 1971; Haberman, 1978) to a contingency table that is basic to analysis of this new social indicator, and models that are useful to analyzing the temporal aspects of the contingency are exploited.[3] (See Duncan, 1975, 1981; and Clogg, 1979, pp. 45–76 for precedents for this methodology.)

1. *The Basic Hypothesis*

Changes in levels of underemployment may be attributed to increased representation in the labor force of groups that normally face high underemployment. Using a similar argument, some analysts attribute several of the percentage points in the unemployment rate to the increased participation of demographic groups that usually have high uemployment (Flaim, 1979; Perry, 1970, Wachter, 1976). Alternatively, underemployment may increase because the rates of underemployment have increased, either for the entire labor force or significant sections of it. We investigate here the hypothesis that changes in the demographic composition of the labor force contribute to a significant extent to the secular rise in underemployment and

the decline in adequate utilization.

We consider five variables: *A*ge (16–19, 20–34, 35–49, 50–64, 65+, for five categories); *S*ex, *C*olor (black, nonblack); LUF (S, U, H, I, M, and A, for six categories), and *T*ime (years 1969–80). Consideration of this contingency is justified in light of the relationships already established. Age variability indicates the so-called 'life cycle' effect in the labor market (see Winsborough, 1978), and examination of the net effect of age on LUF is a first step toward specifying the life cycle dynamic that can be attached to the new measures. In an era of increasing attention to women's relative success in securing the main labor market rewards, sex differentials in underemployment are of intrinsic interest. Introducing color into the contingency is helpful because it isolates an historic source of heterogeneity in the population being sampled. It is important here also because of the policy significance that attaches to color differentials in labor market experience. LUF differentials across color groups, when examined over time, should have much to say about the convergence, or lack thereof, in the color groups over time. Finally, time is an essential aspect of the contingency because it conditions the other relationships that are likely to be observed. Examining the way that the time variable is associated with the various facets of this contingency should give us a clue to (a) the importance of changing demographic composition of the work force, and (b) the importance of 'business cycle' effects, or other time trend effects, on the LUF components.

Some models that are of immediate interest are presented in Table V, including the marginals fit under the models with the associated chi-square statistics. In presenting these models, we do not anticipate that any of them would fit the data well. The models in Table V are devised to infer the 'total effect' of period on the contingency and to decompose it into its sources. (By 'effect' we mean the portion of the chi-square statistic that can be attributed to the time variable; we are not calculating total effects according to some sort of path analysis analogy.) Model H_0 fits the marginal (ASCU) and (T), or it assumes that the joint variable A–S–C–U, including all of the demographic variables and underemployment, is independent of or homogeneous across time. Of course it does not fit the data, but it gives a measure, $L^2(H_0)$, which can be regarded as the total effect of period on the contingency. This quantity itself has no particular meaning apart from the other results which follow; its chief value is as a 'baseline' from which the various effects of time can be partitioned into sources.

TABLE V

Hierarchical log-linear models applied to the age x sex x color x LUF x time contingency table

Model	Margins fit[a]	df	L^2
H_0	(ASCU) (T)	1309	16259
H_1	(ASCU) (TU)	1254	7646
H_2	(ASCU) (TU) (ASCT)	1045	2863
H_3	(ASCU) (ASCT)	1100	11180

[a] A = age in five categories (16–19), 20–34, 35–49, 50–64, 65+); S = sex; C = color (nonblack–black); U = LUF components (S, U, H, I, M, A, for six categories); T = time (1969–1980, for 12 categories). The total sample size (adjusted for weighting) was approximately 815 000.

TABLE VI

Alternative decompositions of L^2 to examine the effect of period, demographic composition, and period–composition interaction

	Method A			
	Model	L^2	$L^2/L^2(H_0)$	Component
1.	H_0	16259	1.000	Total period effect
2.	H_1	7646	0.470	Period–group and period-group underemployment
2(a)	H_1-H_2	4783	0.294	Period-group
2(b)	H_2	2863	0.176	Period-group-underemployment
3.	H_0-H_1	8613	0.530	Period-underemployment
	Method B			
	Model	L^2	$L^2/L^2(H_0)$	Component
1.	H_0	16259	1.000	Total period effect
2.	H_3	11180	0.688	Period-underemployment and period-group-underemployment
2(a)	H_3-H_2	8317	0.512	Period-underemployment
2(b)	H_2	2863	0.176	Period-group-underemployment
3.	H_0-H_3	5079	0.312	Period-group

Source: Table V. See text for discussion of components.

Model H_1 is the first model of interest in this partitioning. It adds to H_0 the fitted marginals denoted by (TU); that is, it allows for 'main effects' of period on underemployment. As would be anticipated from our earlier results, there is a dramatic reduction in chi-square when simple main effects are posited to exist. However, this model does not reduce the value of L^2 to zero, which implies that the entire period effect is not captured by main effects. Other types of period effects include: (a) the effect of period on demographic composition, which would be signified by interactions of ASC with T, and (b) the effect of period on the way that the demographic variables are related to underemployment, signified by the interaction of ASC with T with U. Model H_2 is designed to specify these interactions. Model H_2 adds to H_1 the fitted marginal (ASCT), which reduces the chi-square statistic dramatically. Model H_2 explicitly allows for the sort of interaction spoken of in (a) above, implying that the interaction of the demographic variables with time is great. However, this model still does not fit the data, and the proper inference is that the sort of higher-order interaction referred to in (b) above is also important. Stated in simpler terms, there are marked differences in the way that the age-sex-color groups change their risks of underemployment over time; business cycle effects operate differentially on the selected demographic groups. This, of course, is to be expected, but the value of the model is to give quantitative expression to what our intuition tells us must exist.

Finally, H_3 imposes on H_0 (not on H_1) the fitted marginal (ASCT), allowing for change in demographic composition with time, but not for changes in underemployment with time. It also produces a substantial reduction in chi-square, as would be expected, and it provides an alternative measure of how important the changing demographic composition of the labor force was during this period of time.

The models in Table V lend themselves to partitioning the effects of period (see Clogg, 1979, pp. 45–76), and two different partitioning schemes are outlined in Table VI. Line 1 of Table VI reports the L^2 value for the baseline model H_0. The other lines report the chi-square differences that effectively decompose the source of the time effect. Partitioning Method A attributes 53.0 percent of the period effect to the main effect of time, or the effect of T–U interactions. The second method (Method B) attributes 51.2 percent of the effect to the T–U interaction, which is reported in line 2(a). The close agreement between these two percentages indicates that the al-

ternative partitioning methods give very similar interpretations of the source of the period effect. The period-group interaction, indicated by the (ASCT) marginal, accounts for between 29.4 percent (Method A) and 31.2 percent (Method B) of the total period effects. This shows the magnitude of the changes in demographic composition over time, and some attempt will be made shortly to understand the component sources of this part of the period effect. Finally, the interaction of ASC with U, denoting differences in the way that the demographic groups experience underemployment over time, accounts for 17.6 percent of the total period effect.

Tables V and VI support the hypothesis of a substantial contribution of labor force composition to underemployment rates. Composition is one of the three components of the overall period effect analyzed in those tables, and it accounts for between 29 percent and 31 percent of the total period effect. Another 17.6 percent of the total period effect is explained by the changes in underemployment rates specific to some demographic groups. We now extend the analysis by examining the differential vulnerability of the demographic groups in the labor force.

2. *Results for Specific Demographic Groups*

A direct examination of the components of demographic compositional change requires an analysis of the *marginal* table obtained from the one analyzed earlier, collapsing over the LUF variable. Table VII presents some hierarchical log-linear models applied to this marginal table. (We did not actually create the marginal table in question, but used results presented by Goodman (1971) and discussed by Allison (1980) to obtain the tests for the marginal table in question, using certain models applied to the uncollapsed version of the data.)

Model M_0 is the model of homogeneity, which assumes that demographic composition (ASC) remained constant over time. Once again this model serves as a baseline with which the total effect of period can be partitioned into components. Some of the models are used in the bottom of Table VII for this task. The results show that *age* changes in the composition of the labor force were by far the most important compositional changes between 1969 and 1980. Age changes account for a full 79 percent of the total demographic composition change, and it can be noted that a very coarse definition of age categories was used to produce this result. If finer age categories

TABLE VII

Analysis of the changing demographic composition of the labor force

Model	Marginals fit[a]	df	L^2	L^2/df
M_0	(ASC) (T)	209	5200	24.9
M_1	(ASC) (TA)	165	1080	6.5
M_2	(ASC) (TS)	198	4228	21.7
M_3	(ASC) (TC)	198	5192	26.2
M_4	(ASC) (TA) (TS)	154	208	1.4
M_5	(ASC) (TA) (TC)	154	1066	6.9
M_6	(ASC) (TS) (TC)	187	4216	22.5
M_7	(ASC) (TA) (TC) (TS)	143	187	1.3
M_8	(ASC) (TAS) (TC)	99	91	0.9
M_9	(ASC) (TAS)	111	110	1.0

Partition showing relative importance

	Source	Models used	L^2	df	$L^2/L^2(M_0)$
1.	age–time	M_0-M_1	4120	44	0.79
2.	sex–time, given age–time	M_1-M_4	872	11	0.17
3.	age–sex–time, given age–time and sex–time	M_4-M_9	98	43	0.02
4.	Residual	M_9	110	111	0.02
	Total	M_0	5200	209	1.00

[a] Models pertain to age x sex x color x time table. (Table not shown.)

TABLE VIII

λ^{TCU} parameter estimates from a log-linear model applied to the age x sex x color x LUF x time contingency table[a]

	Estimates for Blacks[b]					
Year	S	U	H	I	M	A
1969	−0.11	−0.03	0.08	0.12	−0.04	−0.03
1970	−0.08	−0.08	0.10	0.10	−0.02	−0.02
1971	−0.06	−0.10	0.08	0.09	−0.03	0.02
1972	−0.11	0.01	0.01	0.06	0.00	0.02
1973	−0.12	0.03	−0.03	0.04	0.03	0.05
1974	0.00	0.02	−0.02	0.02	−0.03	0.02
1975	−0.02	0.00	−0.01	0.01	0.01	0.01
1976	0.11	−0.01	−0.02	−0.06	−0.04	0.02
1977	0.06	0.02	−0.02	−0.11	0.04	0.00
1978	0.07	0.04	−0.01	−0.10	0.05	−0.04
1979	0.13	0.06	−0.10	−0.07	0.01	−0.02
1980	0.13	0.02	−0.06	−0.09	0.02	−0.02

[a] Model fits marginals (ASCL), (ASCT), (ASLT), (CLT).
L^2 = 684 on 495 df, L^2/df = 1.38.
[b] Parameter estimates for nonblacks are of opposite sign.

had been considered there would be an even greater effect associated with age. The sex-time interaction, involving the changing sex composition of the labor force with time, is also substantively important, involving some 17 percent of the total period effect. Color changes and other sorts of more complicated demographic groups changes were inconsequential by constrast, jointly accounting for only about 4 percent of the total period effect on changing demographic composition.

These findings are extremely important for understanding the levels of underemployment that have been reported in this paper. Standardization procedures like those in Clogg (1978, 1979, pp. 45–76) can be used to show that a nontrivial portion of the secular rise in underemployment in this period is directly associated with the increasing relative proportion of the work force in the young age group (20–34), where underemployment risk is excessively high. Rather than pursue this line of inquiry here, we simply note the general importance of demographic composition changes, or ASC–T interaction, and this will serve to justify one set of 'controls' included in the model that is considered next.

Having analyzed the influence of period on the various types of associations that can be of interest in the Age x Sex x Color x LUF x Time contingency, we now consider a tentative model for the data. Model building strategies described in Clogg (1979, pp. 45–76) were used to specify candidate models, and standard procedures (Bishop *et al.*, 1975) were used to determine the adequacy of the results. The hierarchical log-linear model that was settled on fits the marginals (ASCL), (ASCT), (ASLT), and (CLT). The first (four-way) marginal in this configuration corresponds to the 'structural constraint' that underemployment varies by age-sex-color group. Routine procedures can be used to show that this marginal constraint is necessary, that there is a complicated form of interaction among the three demographic variables and LUF. The second (four-way) marginal is included to account for changing demographic composition in the labor force. Previous results indicate that this marginal configuration is necessary (e.g., Tables VI and VII). The third marginal configuration in this model allows for period changes in the way that the age-sex groups experience underemployment; standard procedures suffice to show that this cannot be broken up into separate (ALT) and (SLT) component parts, implying, e.g., that the age–LUF–time relationship differs substantially across sex groups. Finally, the (CLT) marginals in the configuration denote the changing relationship of

color group to underemployment with time. The model in question yields L^2 = 684 on 495 df, with L^2/df = 1.38. Ordinarily, it is desirable to obtain a model with L^2/df approximately equal to one (Haberman, 1978, Ch. 1), but in the present situation such a level of fit is nevertheless acceptable. Adding more complicated interactions does not improve the fit very much in comparison to the sacrifice in degrees of freedom, and the large sample size (approximately 815 000) indicates that the model is performing remarkably well. If we were somehow to take account of the departures of the data from simple random sampling, the model would appear all the more suitable.

Parameter estimates for this model capture all of the important features of the data. In particular, parameter estimates which involve the factor T (time) serve to capture the changing relationships over time; parameter estimates which involve both U (LUF) and T describe the changing levels of underemployment over time. The parameter estimates for the model are rather unwieldy, but they are not so unwieldy as to preclude their serious use in social indicator analysis of LUF. It is easiest to describe the changing relationship of color to LUF over time, since only the lambda parameters for the C–L–T interaction terms are relevant. Table VIII presents these estimates for blacks (estimates for nonblacks are of the opposite sign). A negative value indicates that blacks are less likely, in the given year, to experience tthe particular type of underemployment than in other years.

The first entry in Table VIII (–0.11) indicates that blacks were unlikely to experience the S form of underemployment in 1969, *relative* to the other years in the table. Note that the lambdas are very negative in approximately the first half of the series, and very positive in the later years. This means that blacks experienced a greater likelihood of being in the 'discouraged worker' status with the passage of time. With respect to the U (unemployment) form, much the same ccan be said: relative to whites, blacks experienced greater likelihood of unemployment over time (an exception is 1976). The H and I forms of underemployment show opposite tendencies. For both of these LUF components, later years were associated with less black underemployment. Finally, the trend in M (mismatch) parameter estimates indicates that toward the end of the decade blacks were increasingly likely to experience mismatch. (This latter statement does not mean that black mismatch rates were higher than white mismatch rates at the end of the period; other effects or interactions in the model must be taken into account before a statement of this sort could be addressed.) The trend in these parameter estimates is unmistakably

clear. With the progress of time, blacks are doing worse with respect to the S and U components, and relatively better with respect to the H and I forms. This set of estimates corroborates comments made earlier in connection with Table IV.

Estimates for the other lambda parameters in the model can be used in a similar way to understand how age-sex groups experience changing underemployment risk with the passage of time. The log-linear model applied to repeated cross-sectional surveys, exploiting the time facet of the contingency, is one fruitful manner in which to address the LUF variable from the social indicator perspective. With methods like these, there is little difficulty in analyzing the trend in LUF over time, even though the LUF variable itself is a rather complicated polytomy.

V. DISCUSSION

'Full' employment has been an official government goal since 1947. Nevertheless, level of employment, the indicator currently reported, bears no necessary relationship to the social welfare function. This is true because some workers are inadequately or marginally employed. The Labor Utilization Framework can easily be applied to standard labor force surveys to produce much additional labor force information. As a social indicator, LUF clarifies the relationship between employment and social welfare, fulfilling one objective of indicators of employment quality (Land, 1976, p. 22; Seashore and Taber, 1976, p. 122). Special cases of LUF – for example, measures of 'economic underemployment' – can be developed to examine explicitly such welfare issues as labor-market-related hardship.

The LUF strategy is well suited for social indicators research in at least two fundamental respects. First, it is an objective social indicator, measuring the prevalence of the various types of underemployment identified over the past two decades. Second, it is also suited to the construction of 'normative' social indicators, which gauge how well the labor market performs in distributing its rewards to significant social groupings. LUF is easily adapted to include normative cutoff points, such as the Poverty Threshold, in its construction.

An example of the 'normative' use of this indicator is evident in our analysis of the color-LUF relationship over time. Reduction in color-based differentials in underemployment is surely a goal of employment policy, and

detailed analysis of the LUF–color-time interactions (Table VIII) shows how the color differentials are (and at the same time are not) moving toward more favorable circumstances for blacks. Trends in mismatch rates, which record a striking increase in the prevalence of mismatch over the 12 years studied here, are also of direct policy significance. Whatever the criticisms of the mismatch definition, there can be little question that the education-occupation relationship has changed rapidly, and that this in turn has potentially significant consequences for worker expectations and satisfaction as well as possible consequences for productivity.

Finally, this paper demonstrates how standard log-linear models can be applied to the LUF components when considered in multi-way contingencies. In social indicator analysis, the time variable is always a facet of the contingency of interest, and we were able to analyze how the time variable influenced the LUF components and their association with other (demographic) variables. While the LUF categorization is more complicated than many other approaches used with labor force data, it is nevertheless feasible and desirable to analyze it as a polytomous variable in multi-way contingency tables.

The Labor Utilization Framework is really a *framework* for analyzing the several forms of underemployment in modern work forces. It is not a rigid set of opeational definitions, and presumably others will try to operationalize the components in different ways. Our extensive work with other operational definitions suggests the advantages of the simple procedures used here, but we are not steadfastly wed to them. If the reader is convinced of the need to consider simultaneously the various LUF components – discouraged workers, the unemployed, the part-time unemployed, the workers with low earnings, and the over-educated – then this paper has accomplished its main purpose. Future research can be focused on improvement in operational criteria, including the development of somewhat different labor force surveys than those currently available.

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APPENDIX

A problem with the earlier application of LUF was the difficulty in replicating the operational definitions. This Appendix provides the rationale for the

procedures used to define the I and M indicators in the text.

In both Sullivan (1978) and Clogg (1979), much work was necessary to obtain the 'low income' (I) category. Clogg's used information on *family* or *household* income for determining the income cuts used for primary earners in households, and complicated procedures were used to arrive at cutoffs for 'subfamilies' contained within families or households. Different criteria were applied to men and women, to young and old, and to urban and rural persons, and rather complicated rules were used to provide the criteria for single or 'unrelated' individuals. Although this complicated procedure corresponded to variations in the official poverty threshold (PT), it was difficult for others to replicate (see the very detailed definitions in Clogg's Appendix A). It also assumed that quite different income thresholds should be used to measure work adequacy of workers who differed only in terms of residence, sex, age, or relation to the primary earner in the household. This assumption makes sense for an indicator of economic welfare, but not for an indicator of adequate employment.

To simplify the choice of an income cutoff, we chose an income figure that produced a reasonable association between income level in the preceding year and current unemployment. (For a precedent, see Clogg, 1979, pp. 81–118). Table IX presents unemployment rates by income category for selected years and demographic groups. The year 1969 was a year of 'full employment', with a March unemployment rate of 3.4 percent. The Poverty Threshold and previous year's work-related income were adjusted to a weekly wage, using number of weeks worked. The proportion of the labor force with incomes between the Poverty Threshold (PT) and [1.25 x PT] had 6.4 percent unemployment, an absolute difference of 3.1 percent. As the table indicates, the change from 1.00 x PT to 1.25 x T produces a greater absolute change in unemployment risk than any other comparison of adjacent income categories. This result is true in both 1969 (a full employment year) and 1975 (a recession year with over 9 percent unemployment), regardless of race or sex, and for all age groups for 1975. There are some anomalies for the ages 45 to 64, but in general the results suggest that [1.25 x PT] is a reasonable income cutoff. That is, the uniform standard of 1.25 x PT is low enough to isolate deficiency in earnings and to also isolate a fraction of the labor force with excessively high rates of unemployment. (This low-income labor force, as we have here defined it, also has excessively high risk to the S and H forms of underemployment, but to save space these data are not to be presented.)

TABLE IX

Unemployment rates by income category, for selected years and groups

Group		Income category (poverty cut x ——) 1.00	1.25	1.50	1.75	Total – all groups
1969	Aggregate	9.5%	6.4	4.8	3.9	3.4
1975	Aggregate	20.1	14.5	12.2	11.3	9.2
1969	Male	9.8	6.4	5.0	4.4	2.9
1969	Female	9.3	6.4	4.6	3.6	4.3
1975	Male	21.1	16.1	15.2	14.2	9.0
1975	Female	19.3	13.5	10.5	9.6	9.5
1969	Nonblack	9.1	6.0	4.6	3.6	3.1
1969	Black	11.2	7.9	5.3	5.4	6.4
1975	Nonblack	19.4	14.0	11.8	10.7	8.5
1975	Black	23.7	16.9	14.6	15.1	15.8
1975	Aged 16–24	31.7	21.3	17.7	16.1	17.2
1975	Aged 25–34	20.7	14.1	11.5	12.9	8.6
1975	Aged 35–44	12.7	10.8	9.6	7.5	6.4
1975	Aged 45–54	11.2	7.3	9.9	6.8	5.9
1975	Aged 55–64	4.8	9.9	6.1	7.3	5.5
1975	Aged 65+	5.5	10.5	6.7	9.1	4.9

Source: March Current Population Survey, for relevant years. The actual sample size (for the total labor force) varies from about 60 000 to 75 000. Total employment rates can be compared with published figures in U.S. Bureau of Labor Statistics (1969, 1975), *Employment and Earnings*, April issue.

Table X presents the unemployment-by-income contingency table that results from application of the 1.25 x PT rule to 1970 data, the only year for which comparable data are available from both Sullivan and Clogg. Unemployment risk is predicted better with the old approach, but the adequate income labor force has nearly identical unemployment risk with each method. The log-odds ratio, which summarizes the association between income and unemployment, is 1.0 with the new approach and 1.8 with the old approach. There is some slippage in the new definition of the I component, if we use the goal of maximizing association with unemployment as the sole criterion. But the approach nevertheless seems reasonable because it is simple to apply, it yields nearly identical measures of the incidence of the low-income form of underemployment, and it does not 'discriminate' among individuals according to household characteristics (family size, primary earner vs. secondary earner, etc.). Given the benefits associated with the new method, the decline in U–I association seems acceptable.

As a further test of the new method, we cross-classified U, H, I, M, A, using both the new and old approaches. (Without the use of an ordering scheme [see text], it is possible to classify workers into more than one category of underemployment [Clogg, 1979, 1980].) Because the S component refers to persons who are not currently in the labor force, it is excluded. Table XI has 12 cells rather than 16 because some combinations of the variable categories cannot occur together (e.g., U and H). Table XI is noteworthy for the close similarity of the distributions from the two approaches. We regard the index of dissimilarity of 2.1 percent as acceptably small. Thus, the actual structure of underemployment inferred from the two approaches is very similar. The scaling and latent structure models applied by Clogg (1979, pp. 81–118) would lead to very similar results when applied to results from the new approach. Other studies of the comparability between the new approach and the old approach, including several other definitions of key LUF components, support the adoption of the simplified approach.

The measurement of mismatch follows exactly the techniques of Sullivan (1978) and Clogg (1979) and we present Figure 1 for readers interested in replicating the measure. Labor force surveys in the United States since 1971 have used the 1970 Census classification of occupations; the 1980 Census classification scheme, which is quite different from the 1970 scheme, will not be used in standard surveys (like the CPS) until 1983. Mismatch criteria

TABLE X

Unemployment by income, for two definitions of income group, for 1970

	Sullivan (1978) and Clogg (1979)[a]		New Approach[b]	
	Income		Income	
	Low	Adequate	Low	Adequate
Unemployed	17.4%	3.5	10.3%	4.0
Employed	82.6	96.5	89.7	96.0
	100.0	100.0	100.0	100.0
% is class	9.4%	90.6	9.4	90.6
Odds-ratio	5.8		2.8	
log-odds-ratio	1.8		1.0	

[a] See Clogg (1979, p. 88, Table 5.3). Percentages refer to persons 14+ in labor force.
[b] Low-income category defined in relation to standard of 1.25 x poverty threshold for male individual, in urban area, under age 65. Percentages refer to persons 16+ in labor force.

TABLE XI

Cross-classification of labor force by underemployment from, 1970

LUF component: U H I M	Sullivan's (1978) and Clogg's (1979) procedure[a]	New procedure	Difference[b]
+ − + +	0.1%	0.1%	0.0
− + + +	0.1	0.1	0.0
− − + +	0.6	0.7	−0.01
+ − − +	0.3	0.3	0.0
− + − +	0.1	0.1	0.0
− − − +	9.4	8.0	+1.4
+ − + −	1.5	0.9	+0.6
− + + −	0.8	0.8	0.0
− − + −	6.3	6.8	−0.5
+ − − −	2.9	3.3	−0.4
− + − −	1.7	1.6	0.1
− − − −	76.2	77.3	−1.1
Total	100.0	100.0	0.0

[a] See Clogg (1979, p. 86).
[b] Index of dissimilarity between the two distributions is 2.1 percent. If calculations are based only on the percent distributions of the underemployed, the index of dissimilarity is 6.9 percent.

```
COMPUTE         REVED=EDUC
IF              (COMGRD EQ 1)REVED=EDUC + 1
COMMENT         ************************************************************
                 THE FOLLOWING MATCHING RECODE COMBINES OCCUPATIONS WHICH
                 ARE HOMOGENEOUS FOR MEDIAN EDUCATION, BY MEAN YEARS OF
                 EDUCATION PLUS ONE STANDARD DEVIATION.  THIS MAPPING
                 IS BASED ON A PREVIOUS ANALYSIS.
                ************************************************************
COMPUTE         MISSA=NOCC
COMPUTE         MISSB=NOCC
COMPUTE         MISSC=NOCC
RECODE          MISSA(690=1)(390 820 831=2)(304 490 515 801 THRU 804
                823 824 834 902 970 972=3)(401 THRU 403 405 THRU 413 415
                425 431 THRU 444 452 472 475 THRU 480 491 492 495 THRU 501
                505 THRU 510 513 514 521 THRU 523 535 THRU 601 610 613 621
                630 THRU 640 642 THRU 645 651 THRU 673 675 THRU 685 691
                THRU 695 703 THRU 713 715 THRU 721 810 THRU 814 821 830 835
                841 851 854 874 THRU 901 903 960 THRU 965 971 973 THRU
                985=4) (ELSE=0)
RECODE          MISSB(265 303 305 THRU 320 323 THRU 360 381 THRU 383 404
                414 420 THRU 424 430 450 451 453 THRU 461 465 THRU 471 473
                474 493 494 502 THRU 504 512 520 524 THRU 530 602 THRU 605
                610 612 614 THRU 620 641 650 701 714 775 815 825 832 840
                842 THRU 850 852 853 860 905=5)     (70 73 74 103 104 120
                150 151 163 164 181 185 THRU 192 250 THRU 262 275 THRU
                280 290 301 302 370 385 393 394=7)(10 THRU 12 14 15 20
                72 84 101 154 161 165 THRU 170 184 195 222 270 285 321
                380=8)(ELSE=0)
RECODE          MISSC(0 13 21 22 75 THRU 83 85 THRU 93 102 111 130
                160 171 172 174 182 193 395=9)(23 THRU 60 71 105 131
                THRU 145 152 153 162 173 175 THRU 180 183 184 200=10)
                (ELSE=0)
COMPUTE         MATCH=(MISSA+MISSB+MISSC)
COMMENT         ************************************************************
                 VOLUNTARY PART-TIME WORKERS (REASON35=12,13 OR EMPSTAT=5)
                 AND THOSE WITHOUT AN OCCUPATION CODE (NOCC=999)
                 ARE COUNTED AS NOT MISMATCHED.
                ************************************************************
COMPUTE         MISMATCH=2
IF              ((LABFORCE EQ 2) AND ((REVED-MATCH) GT 10))MISMATCH=1
IF              ((NOCC EQ 999) OR
                (LABFORCE EQ 2 AND ((REASON35 GE 12 AND LE 13) OR EMPSTAT
                EQ 5)))MISMATCH=2
IF              (LABFORCE EQ 1)MISMATCH=0
14600
```

Fig. 1. SPSS control cards for determining mismatch: 1970 U.S. occupation codes.

developed for the 1970 benchmark, using the 1970 Census classification, will therefore be useful for a wide variety of research purposes. Figure 1 presents SPSS control cards that determine mismatch cutoffs. The REVED variable is completed years of schooling; it is constructed from the standard schooling variable (EDUC), which codes the highest 'grade' of school that the individual has attended, and the variable COMGRD which measures (1 = yes) whether the individual completed the 'grade'. NOCC is the three-digit occupation classification, and the statements break up the recoding into three separate tasks. A comment card toward the end of the figure indicates the special way that *voluntary* part-time workers and workers who do not have an occupation to report are handled. The reader may consult Sullivan (1978) or Clogg (1979) for further restrictions that might be of interest in measuring mismatch (e.g., the treatment of college students). Empirically, these definitions record mismatch only for individuals who have completed more than 12 years of schooling. Thus, the mismatch rates in this paper are actually based on persons with some post-high school education.

NOTES

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[1] This conclusion is strongly supported by Sullivan's (1978, pp. 36–37) detailed comparison of LUF with alternative measures (Wirtz, 1966; Spring *et al.*, 1972; Levitan and Taggart, 1973, 1974; Miller, 1973; Vietorisz *et al.*, 1975). However, we have combined several of Sullivan's comparison categories into the more inclusive concept 'currency'.

[2] 'Subjective' measures of mismatch are much higher. In a survey of workers currently employed at least twenty hours a week, 21.6% strongly disagreed with the statement, "My job lets me use my skills and abilities" (Quinn and Staines, 1979, p. 194). Among workers reporting work-related problems, 35.6% indicated that 'underutilization of skills' was a problem; 32.2% reported that 'overeducation of the worker' was a problem (Quinn and Staines, 1979, p. 292).

[3] The CPS uses a rotation scheme in its sampling arrangement, whereby about one-half of the persons sampled in year t also appear in year $t + 1$. This sort of dependency is not dealt with here: the methods are applied as if the samples were independent of each other, implying that chi-square statistics should be taken only as descriptive indexes of fit. The resulting contingency table is of dimension $5 \times 2 \times 2 \times 6 \times 12$, for 1440 cells, and the weighted sample size is approximately 815 000.

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