J. of Population Studies, No. 9
Pp. 131-169, June 1986
Taipei: Population Studies Center, NTU

THE LATENT STRUCTURE OF OCCUPATIONAL INCONGRUITY FOR TAIWAN'S LABOR FORCE

*Yeu-Sheng Hsieh**

INTRODUCTION

The magnitude, determinants, and consequences of manpower underutilization have become central topics in recent studies of labor market (Rumerger, 1981; Clogg, 1979a, 1980; Hauser , 1974, 1977; Carter, 1982). Researchers and policy-makers in Taiwan are also concerned about these issues. Unemployment and undermployment[1] rates in Taiwan have declined and remained at a low level since 1965, even in the recession years. For example, the unemployment rate was 4.7 percent in 1965, 1.7 percent in 1970, and 1.2 percent in 1980. The underemployment rate was 1.6 percent in 1970, declining from 3.2 percent in 1965 (Hou, 1975; Chang, 1981). But it should be noted that the existing manpower underutilization statistics provide only a partial picture of the true labor utilization problem in Taiwan. Data on the labor force, collected by the conventional labor force approach, tend to obscure important information pertinent to Taiwan's labor utilization. Thus, after three experimental surveys, a modified labor utilization framework was formally adopted in the labor force survey starting in 1979.[2] Besides, Liu (1982) found that 10.8 percent of the labor force was inadequately utilized in large cities, compared with 11.9 percent in intermediate cities, and 14.8 percent

---

* Instructor, Department of Agricultural Extension, National Taiwan University, Taipei, Taiwan, R.O.C.

[1] Underemployment here is defined as a worker who worked 1-36 hours per week and is willing to work more (for paid work) or 15-36 hours per week and is willing to work more (for unpaid workers in family owned enterprises).

[2] The most controversial problem of Hauser's labor utilization framework is the choice of criteria for the cutting points of indicators. Those cutting points have been modified in a way that seems satisfactory for Taiwan's labor force.

in the remainder of Taiwan in 1978. The main type of underutilized labor in large and intermediate cities was due to educational mismatch, while in the remainder of Taiwan low income work was more prevalent. Underemployment due to educational mismatch was 6.6 percent in large cities, 5.2 percent in intermediate cities, and 3.4 percent in remaining areas. In contrast, underemployment measured by low income was 2.0, 3.7, and 7.8 percent, respectively. Unemployment and underemployment in low hours were found to be less important; the unemployment rate was 1.5, 1.6, and 0.9 percent and underemployment in low hours was 0.7, 1.4, and 2.7 percent for large, intermediate cities and other areas, respectively.

In addition, Taiwan's manpower utilization in 1975 showed widespread mismatch among the well-educated labor force in the labor market (Kao and Hsu, 1976). The problem of high-level manpower mismatch in Taiwan has become more serious since 1975 and has been an object of concern by decision makers involved in manpower planning and, since 1980, by those responsible for educational planning. A survey conducted by the Ministry of Education in 1974 clearly demonstrated a severe mismatch between the supply of high-level education graduates and the demand for their specializations in the labor mrket. Further, in the recent years, college graduates have tended to fill positions formerly held by junior college graduates, and junior college graduates in turn have replaced high school graduates.

Recognition of the problem of labor underutilization has made an assessment of the distribution and the structure of occupational incongruity in the labor market an important component of policy research in Taiwan. Occupational incongruity in this study includes involuntary part-time work, excess hours of work, relatively low income work, and educationally mismatched work. In spite of wide recognition of the prevalence of the types of occupational incongruity, little is known about the class structure of occupational incongruity or, alternatively, about the class structure of the distribution of the labor market outcome in terms of work hours, income, and skill utilization. This study, therefore, attempts to address this issue and advance explanations of occupational incongruity by estimating the class structure of occupational incongruity and assessing the difference in the class structure between male workers and female workers in Taiwan's labor market. In other words, it uses a large nationwide sample with information on labor utilization to examine the class structure of occupational incongruity and compare sex differences in these class structure.

LABOR MARKET OUTCOMES AND OCCUPATIONAL INCONGRUITY

Since occupational incongruity, except the indicator of excess hours of work, is similar to the concept of underemployment, the theoretical perspective of occupational incongruity can be approached by reviewing the literature on underemployment. There is no single model of underemployment, instead there has been a variety of alternative approaches, each highlighting a different aspect of labor market outcomes, such as earning or income, work hours, and skill utilization. Hauser (1974, 1977) has proposed the Labor Utilization Framework (LUF) to measure underemployment systematically. Through the efforts of Clogg (1979a; Clogg and Sullivan, 1983) and Sullivan (1978), this framework has become the most widely used approach to underemployment in this field. However, the LUF has undergone several changes in operationalization (Sullivan, 1978; Clogg, 1979a; Clogg and Sullivan, 1983). In its current form the LUF includes seven utilization categories: (1) not in the labor force, (2) discouraged worker, (3) unemployment, (4) part-time unemployed or involuntary part-time workers, (5) low-income underemployment, (6) occupational mismatch, and (7) adequately employed (Clogg, 1979a; Clogg and Sullivan, 1983). This study focuses on three forms of underemployment, involuntary part-time work, low income work, and educational mismatch, plus an additional indicator—excess hours of work, to represent work hours, earnings, and skill utilization dimensions of the job, and is termed occupational incongruity.

To determine the distribution of occupational incongruity effectively requires assigning each currently employed worker one of the four forms of occupational incongruity. It is well known that involuntary part-time work, low income work, and educational mismatch tend to vary together, that is, if one is in involuntary part-time work, he is also likely to be in low income work, and vice versa (Clogg, 1979a). It is noted that excess hours of work may not be a problem of occupational incongruity in the developed countries like the United States, but it is an important dimension of occupational incongruity in less developed countries. Although Taiwan's economy has reached the status of a developed country in recent years, excess hours of work still popularly exist in the labor market.

The distribution of job rewards has been examined intensively in the past. The dominant stream of research in earnings or income determination utilizes the theory of human capital. Human capital theory (Schultz, 1961; Becker, 1975; Mincer, 1974; Ben-Porath, 1976; Blinder and Weiss, 1976) holds the view that people invest in themselves, in their own self-interest for the sake of future gains in lifetime earnings. Increasing the resources in people is called human capital investment. Total human capital is the sum of a variety of investments, including formal education, on-the-job training, search activities, and health expenditures, etc. In general, total human capital per worker in an industry can be directly measured by years of schooling, qualitative measures of skills, length of tenure and physical capital.

The key elements of human capital theory are the presumed relationships among schooling, productivity, and the labor market which is considered in the Becker-Mincer formulation. Human capital investment generally can be divided into two categories: general human capital investment and firm-specific human capital investment (Jovanovic, 1979). The former is transferable from one firm to another firm while the latter is not. Workers accumulate firm-specific capital as they work at a firm. The more accumulated firm-specific capital the higher the wages received. This approach concentrates upon supply-side decisions of individuals. Individuals make a series of investment decisions, such as schooling or on-the-job training decisions, with the expectation of higher earnings in the future. The focus of these studies is on the heterogeneity of workers as measured by such things as schooling differences, ability, and experience. This implies that workers with different schooling, abilities, and experiences have differential earnings or income in the labor market, and further, have different risks of occupational incongruity.

However, while human capital research is the dominant stream of research, it is not the only one and it has received a number of critical assessments and comments regarding empirical anomalies and failures of policies predicted upon human capital theories (Sobel, 1982). Sociological research on the distribution of job rewards has been dominated by the status attainment perspective (Blau and Duncan, 1967). It has tended to focus on occupational status as the crucial job reward and to stress the role of education in the transmission of parental status to the next generation (Kalleberg and Sorensen, 1979). The literature views income as determined by occupational status and thus by the education and background of the individual.

Institutional theorists strongly indicate a need for substantial revision of the neoclassical based model. They emphasize the role of monopolies, unions, employer specification unrelated to productivity, discrimination, the presence of "job" rather than "wage" competition, and other noncompetitive characteristics to argue the failure of the link between productivity and earning. Specifically, this alternative view concentrates not on differences among workers but on aggregate earning differences as related to characteristics of workers' employment. In particular, aggregate earning differences have been examined by employing industry, by occupation, by location or region of employment (Osterman, 1975, Gordon, 1972; Piore, 1973; Hodson, 1978; Freedman, 1976).

Institutional economics and organizational theory, as well as industrial and occupational sociology have provided a number of typologies of the labor market: primary and secondary markets (Doeringer and Piore, 1971); external and internal markets (Doeringer and Piore, 1971); center (core), periphery, and irregular sectors (Averitt, 1968; Bluestone, 1970); monopoly and competitive sectors (Gordon, 1972, O'Connor, 1973). These typologies presumably capture characteristics of industries, firms and jobs that should affect employment patterns, job attachment, and the attainment of workers. They further suggest the means for interpreting the forms of workers' attainments, earnings and behaviors. The literature on these perspectives usually demonstrates how individual differences in labor market outcomes are related to characteristics of employers and industrial organizations, but the reasons for the differences are not clear nor agreed upon.

Moreover, the "new structuralists" have relied largely on "dual" or "segmented" economy perspectives drawn from institutional and Marxist economics to examine the effects of organizational structure on labor market outcomes. That is, dual or segmented labor market proponents focus upon the argument that markets are defined based on the characteristics of job rather than workers' human capital. The primary labor market consists primarily of jobs in large firms and/or unionized jobs and occupations with the characteristics of high wages, good working conditions, employment stability, and chances for advancement mainly prescribed by internal labor market rules and processes. In contrast, the secondary labor market is composed of jobs with the characteristics of less attractiveness, low wage, poor working conditions, considerable instability in employment, and little chances of promotion. These characteristics or structural differences in economic divisions are believed to have a substantial impact on labor market outcomes and lead to different forms of occupational incongruity.

Workers in the primary labor market generally have higher earnings, better than average working conditions, better nonwage benefits, and hierarchical work arrangements than their counterparts in the secondary labor market (Hodson, 1978; Scott, 1981). The studies based on dual labor market perpectives have seldom considered differences in worker characteristics, but the implicit notion is that the structural characteristics of social and job inequalities represent the key determinants of earnings which lead to different risks of underemployment or occupational incongruity.

While human capital theory is criticized for emphasizing the determination of market outcomes merely on the individual, much of the segmented labor market is also criticized for focusing on the market too heavily. A formulation considering both the individual and the market has been proposed by Thurow (1975). Two types of markets, wage competition and job competition, have been taken together to examine the labor market outcomes. The wage competition market nearly corresponds to the secondary labor market of segmented theories, in which workers generally have low skills and wages are determined by the marginal productivity of the worker as in the human capital theory. The lower unskilled jobs, which are less complex and require little training, are less secure and less rewarding both materially and psychologically, both of which may lead to high risks of occupational incongruity. In contrast, the job competition market is fundamentally filled by a higher skilled worker. The higher skilled jobs require more training, usually on the job or as an apprentice. And, they are usually better paying and more secure, and may create little risk of experiencing occupational incongruity. Also, employers in the job competition maiket always hoard their skilled labor to a greater degree than unskilled labor after filling a position due to the high hiring and training costs of higher skilled workers. Thus, stability of employment, low risks in occupational incongruity, and high satisfaction of job are found in this type of market (Tolbert et. al., 1980).

In addition to the theories related to the dimension of earnings or income, the time allocation model (Becker, 1965; Michael and Becker, 1973; Gronau, 1977; Pollak and Wachter, 1975) and the new home economics (Berk and Berk, 1983) have been formulated to deal with the dimension of work hours. In general, the decision to work has two steps. First, the individual decides whether he or she will work. Second, they must decide how many hours to work. In spite of only two steps, the decision to work always includes consideration of many complicated factors such as the wage rate, nonlabor income of the family and other factors (Fleisher and Kniesner, 1980). From economic perspectives, it is recognized that an individual's use of time, particularly the allocation of time among market, leisure, and home production activities, may be better understood within the context of the family. It is assumed in these theories that once an individual makes the decision to work and decides how many hours to work, a job can be found. However, those theories ignore the demand side of the labor market and only emphasize the labor supply of the individual. In reality, some people find jobs they prefer, but some are unable to find acceptable jobs. As a result, some persons decide to work at full-time jobs, but can only find part-time jobs in the labor market. This type of occupational incongruity may produce tensions and may further lead to negative life chance. In contrast, if a person has a strong preference for leisure time, then he or she may avoid working at a job requiring long work hours. However, if for some reason a job is accepted that requires much longer work hours than those expected, this situation may produce another type of occupational incongruity which is related to work hour dimension of labor market outcome.

Finally, skill underutilization has been examined in terms of educational mismatch or overeducation. Educational mismatch means that there is an imbalance between the occupation-specific demand for labor and the schooling-level-specific labor supply (Clogg and Shockey, 1984). This topic has become an important policy concern since 1970 (Berg, 1970; Freeman, 1975, 1976, 1980; Rumberger, 1981). Most research on educational mismatch has focused on returns to schooling which are based on the views from human capital theory. And, several recent studies (Clogg, 1979a; Clogg and Sullivan, 1983; Clogg and Shockey, 1984; Hauser, 1974, 1977; Rumberger, 1981; Tipps and Gordon, 1985) center on devising measures of mismatch and other types of underemployment. However, recent attention has also been given to the consequences of educational mismatch (Burris, 1983).

Clogg and Shocky (1984) have compared four different approaches to the measurement of educational mismatch. The first approach uses subjective reports of overeducation or underutilization of skill. The second approach is based on the comparison of GED (General Education Development) scores available from the DOT (Dictionary of Occupational Title) and education. The third approach is based on the schooling-earning relationship which is implicit in Freeman's (1976) analysis of earnings of recent college graduates. And the fourth approach is conceived in terms of the comparative "fit" or "match" between years of schooling and occupation. They conclude that the fourth approach produces quite conservative measures of mismatch prevalence after evaluating the available evidence. Therefore, the fourth approach is employed to measure educational mismatch in this study.

A key issue concerning occupational incongruity is whether differences in labor market outcomes in terms of work hours, income, and skill utilization are to be attributed to some distinct classes of workers' population or to the relationship between distinct classes of workers and a particular observed type of occupational incongruity. Many dual labor market proponents have emphasized that class or structural characteristic shapes labor market outcomes. The argument here is that labor market outcomes can be characterized by some distinct classes of workers. And, each distinct class of workers has different risks of experiencing observed types of occupational incongruity. Even though gender differences in labor market outcomes have been popularly discussed and studied either in the developed countries or in the less developed countries, little evidence has been provided to substantiate the interest— whether male workers and female workers are completely homogeneous, partially homogeneous, or completely heterogeneous groups in the labor market with regard to classes of workers and the risk of being observed types of occupational incongruity in each class.

DATA AND VARIABLES

The data for this study come from a nationwide labor utilization survey conducted in May, 1981, by the Office of the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China. The survey utilized a national probability sample of households. The sample households were designed to be representative of all 361 townships in Taiwan. Information on labor force participation and labor utilization, and the social and demographic characteristics of each person 15 years old and over in the sample household were obtained (Stokes and Hsieh, 1983).

The sample consisted of 53,139 individuals 15 years old and over. However, the analysis is restricted to the 21,310 respondents who were currently employed, aged 15 to 50, and for whom complete data on occupation, years of schooling, and income were available. There are 14,333 males and 6,977 females included in the analysis.

Occupational incongruity is composed of four indicators—involuntary part-time work, excess hours work, relatively low income work, and educationally mismatched work. First, involuntary part-time work refers to persons who are working at a part-time job, but who want to increase their working hours. Second, excess-hours refers to the main working hours measured by the mean plus one standard deviation. Forty-eight hours was initially chosen because it is the maximum working hours per week under the "Labor Standard Low" in Taiwan. However, in this study, the mean working hours in the total sample is 50.0 hours per week, with a standard deviation of 8.6 hours. The sum of these two quantities is 58.6, which rounds up to 59. Thus, a worker who works 60 hours per week or more is classified as an excess-hours worker.

Third, relatively low income work refers to workers whose monthly income from their main paid jobs is less than the mean income of total employed workers, minus half of its standard deviation. In the present study, a worker is identified as a relatively low income worker if the monthly income from the job is less than 6,190 N.T. dollars which is the mean (9,918) minus half of the standard deviation (1/2*6,016). This cutting point is chosen to reflect the subsistence income needed by an individual worker each month. Also, it should be noted that relatively low income here is not equivalent to poverty low income in the LUF.

Finally, educational mismatch is measured as that in LUF by using years of formal schooling and occupational categories, that is, measurement of mismatch is based on a comparsion between the educational attainment of each respondent and the amount of education necessary or likely to be utilized in his or her present occupation. Any worker who has more schooling than the mean plus one standard deviation in the occupation category is classified as an educationally mismatched worker. The mean and standard deviation of years of schooling are computed separately for each of sixty-two occupation categories, which were reduced from the original seventy-four categories. Occupational categories are combined with other categories in the same one digit occupation code if the sample size is less than 10. To ensure that the procedure used to collapse categories does not distort the relationship between education and occupation, an analysis of variance was conducted. The results reveal the sum of squares between occupational categories changes only .07 percent and multiple R-square stays the same, indicating that collapsing categories from 74 to 62 does not distort the relationship between education and occupation.

STATISTICAL METHODS AND PROCEDURES

In order to understand the basic structure of occupational incongruity, in addition to descriptive statistics, the latent class model (Goodman, 1974a, 1974b; Clogg, 1979a, 1980, 1981a, 1981b) is employed to characterize the latent variable that explains the observed combination or distribution of occupational incongruity. Basically, this will be achieved by (1) estimating the relative frequency distribution or class structure of the latent variable, (2) estimating the relative frequency distribution of observed occupational incongruity for each category or class of the latent variable, and (3) inferring from (1) and (2) the substantive meaning of the latent variable in Taiwan's labor market (Clogg, 1980).

The latent structure model is discussed in detail by Goodman (1974a, 1974b), Clogg (1979a, 1979b, 1980, 1981a, 1981b), and Clogg and Goodman (1984). A limited discussion of the model is presented here. For purposes of the study, the latent structure notation for the three-way cross-classification of manifest variables A, I, and M is briefly described below. Suppose we hypothesize that the relationship among these three manifest variables can be explained by a single factor X having T classes, but X itself is unobservable or latent. Let π_{ijk} denote the population probability (in other words, the expected proportion) in the (i, j, k) cell of the cross-classification of manifest variables A, I, and M, where i = 1, 2, 3, j = 1, 2 and k = 1, 2. If X has T classes, then

$$\pi_{ijk} = \sum_{t=1}^{T} \pi_{ijkt}^{AIMX}, \qquad (1)$$

where

$$\pi_{ijkt}^{AIMX} = \pi_{t}^{X} \pi_{it}^{\bar{A}X} \pi_{jt}^{\bar{I}X} \pi_{kt}^{\bar{M}X} \qquad (2)$$

denotes the probability that a worker is at level (i,j,k,t) with respect to variables (A, I, M, X). The parameters π_{t}^{X} refer to the probability that a worker will be a member of the t-th latent class of X, while $\pi_{it}^{\bar{A}X}$, $\pi_{jt}^{\bar{I}X}$, and $\pi_{kt}^{\bar{M}X}$ refer to the conditional probability that a worker will be observed in i-th, j-th, and k-th level of manifest variables A, I, and M, respectively, given that a worker is in the t-th class of latent factor X. It is noted that equation (1) implies that there are T mutually exclusive and exhaustive latent classes of workers, and equation (2) implies that, within each latent class, responses on the A, I, and M observed variables are mutually independent. In other words, the hypothesis is that the manifest variables are conditionally independent of one another, given the latent factor. Thus the set of parameters of latent class proportions π_{t}^{X}, t = 1, 2, . . . , T, provide information with respect to the distribution among the classes of the latent factor, whereas the conditional probabilities, $\pi_{it}^{\bar{A}X}$, $\pi_{jt}^{\bar{I}X}$, and $\pi_{kt}^{\bar{M}X}$ provide information on the relationship between a certain manifest variable and latent factor X. Various restrictions can be placed on both latent class proportions and conditional probabilities.

The latent structure model enables us to characterize the distribution of latent classes of workers in the population or, alternatively, the class structure or distribution of labor market outcomes in terms of work hours, income, and skill utilization. It also provides a basis with which to identify the relationship between a particular observed type of occupational incongruity and distinct class of workers. Clogg's (1977) program of MLLSA (Maximum Likelihood Latent Structure Analysis) is used to estimate and test the models. It should be noted that the class analysis proposed here is analogous to that in Clogg (1980, 1981c), Breiger (1981), and Marsden (1985).

Besides, the simultaneous latent class models (Clogg and Goodman, 1984, 1985) are used to examine sex differences in occupational incongruity in term of complete homogeneity, partial homogeneity, or complete heterogeneity in latent class between males and females. This comparison allows us to test whether the distribution of the latent variable is the same for males and females, to test whether the observed occupational incongruity is an equally reliable indicator of the latent variable in each sex group, and to test whether the model applied separately to each sex group can be replaced by simpler models with across-group homogeneity constraints on the parameters (Clogg and Goodman, 1984, 1985).

The simultaneous latent structure model is an extension of the latent structure model for a single group. Detailed discussion also has been provided by Clogg (1984), Clogg and Goodman (1984, 1985), and Clogg and Munch (1984). For convenience of discussion in the study, it is necessary to describe some features and notation briefly for the model. Now the three-way cross-classification of manifest variables A, I, and M is available for each of two groups, male workers as group 1 and female workers as group 2. The group variable here is denoted by G, and the groups are indexed by $s=1, 2$. Then the observed contingency table can be viewed as a four-way table involving A, I, M, and G.

Let π_{ijks}^{AIMG} denote the population probability in the (i, j, k, s) cell of the cross-classification of variables A, I, M, and G, wher $i=1, 2, 3$, $j=1, 2$, $k=1, 2$, and $s=1, 2$. And let $\pi_{ijks}^{\overline{AIM}G}$ denote the conditional probability that a worker in the s-th group will be at level (i, j, k) with respect to A, I, and M. If X has T classes in each group, then the simultaneous latent structure model can be expressed as

$$\pi_{ijks}^{\overline{AIM}G} = \sum_{t=1}^{T} \pi_{ijkst}^{\overline{AIM}G\overline{X}}, \tag{3}$$

where

$$\pi_{ijkst}^{\overline{AIM}G\overline{X}} = \pi_{st}^{G\overline{X}} \, \pi_{ist}^{\overline{A}GX} \, \pi_{jst}^{\overline{I}GX} \, \pi_{kst}^{\overline{M}GX}. \tag{4}$$

In equation (3), $\pi_{ijkst}^{\overline{AIM}G\overline{X}}$ denotes the conditional probability that a worker in the s-th group will be at level (i, j, k, t) with respect to the unobservable variable (A, I, M, X). In equation (4), $\pi_{st}^{G\overline{X}}$ denotes the conditional probability that X takes on level t for a worker of the s-th group and it refers to the latent class proportions for the s-th group. The parameters $\pi_{ist}^{\bar{A}GX}$, $\pi_{jst}^{\bar{I}GX}$, and $\pi_{kst}^{\bar{M}GX}$ refer to the conditional probability that a worker of the s-th group will be observed in i-th, j-th, and k-th level of manifest variables A, I, and M, respectively, given that a worker is in the t-th class of latent factor X.

The various restrictions, including both within-group restrictions and across-group restrictions, can be imposed on latent class proportions or on conditional probabilities, or on both. Different restrictions are associated with different propositions related to the differences among groups. These procedures enable us to evaluate the complete homogeneity, or complete heterogeneity across groups. For example, if no across-group homogeneity constraints are imposed, a model of complete heterogeneity is considered. This model says that the groups are completely heterogeneous in terms of latent class structure. If homogeneity in all latent class proportions is assumed, one kind of partial homogeneity model is obtained. This model indicates that the latent class proportions are homogeneous across groups. If homogeneity constraints are imposed on some, but not all, of the conditional probabilities $\pi_{ist}^{\bar{A}GX}$, $\pi_{jst}^{\bar{I}GX}$, and $\pi_{kst}^{\bar{M}GX}$, then another kind of partial homogeneity is examined. Finally, a model of complete homogeneity is obtained when constraints on both latent class proportions and all conditional probabilities are imposed simultaneously. This model expresses that the groups are completely homogeneous in their latent structures.

Each of the constraints discussed above can be tested by using the relevant conditional test statistics based on comparison of various nested models. Nested models can be tested against each other through examination of the differences between the likelihood ratio chi-square values (L^2) associated with the two models, with degrees of freedom (d. f.) equal to the difference between the number of parameters estimated by the two models (Fienberg, 1980). In other words, chi-square tests comparing various nested models can be utilized to assess the statistical significance of intergroup differences in estimated parameter values. An understanding of the differences in the latent structure between males and females can be achieved through testing proposed constraints or searching for suitable restrictions.

THE DISTRIBUTION OF OCCUPATIONAL INCONGRUITY

Before turning to the latent class structure of occupational incongruity, it is useful to describe the notation for indicators. Let L, E, I, and M denote the four dichotomous indicators of occupational incongruity referring to low hours, excess hours, relative low income, and educational mismatch, respectively. For each variable, let category 1 denote presence of a particular type of occupational incongruity and let category 2 denote absence of a particular type of occupational incongruity. A worker who is a low hours worker cannot be an excess hours worker, and vice versa, because the (1, 1) combination of (L, E) is impossible in four-way cross-table. Therefore, we only consider a joint variable A with three categories, where there is one-to-one correspondence between A = [(1), (2), (3)] and (L, E) = [(1, 2), (2, 1), (2, 2)]. The first category of A denotes involuntary part-time, the second category of A denotes excess hours, and the third category of A denotes an absence of the work hour dimension of occupational incongruity (Clogg, 1979a, ch. 5).

Table 1 presents the twelvefold cross-classification of A, I, and M of workers who are 15-50 years old and currently employed. It contains the frequency and the percentage for the total workers, male workers, and female workers, respectively. The scale type corresponding to each cell is also designated in Table 1. The cells corresponding to (A, I, M) = (1, 2, 2), (2, 2, 2), (3, 1, 2), (3, 2, 1), and (3, 2, 2) in Table 1 indicate that workers are located in only one type of occupational incongruity which are low hours only, excess hours only, low income only, educational mismatch only, and occupational congruity. Other combinations correspond to workers experiencing multiple occupational incongruity, meaning that workers have joint types of occupational incongruity. As shown in Table 1, 93.1 percent of workers are located in the cells corresponding to only one type of occupational incongruity and 6.9 percent of workers are located in the cells corresponding to multiple occupational incongruity.

Various percentages of workers who are occupationally incongruent with respect to only one type of occupational incongruity relative to all workers who are occupationally incongruent with respect to that same type of occupational incongruity are also shown in Table 1. It indicates that 42.2 percent of low hours

Table 1. Twelvefold Cross-Classification of the Types of Occupational Incongruity

A-I-M	Frequency			Percent			Meaning	Scale Types
	Total	Male	Female	Total	Male	Female		
1 1 1	18	16	2	.08	.07 (.11)	.01 (.03)		0
2 1 1	38	17	21	.18	.08 (.12)	.10 (.30)		0
3 1 1	573	280	293	2.69	1.31 (1.95)	1.38 (4.20)		0
1 2 1	13	11	2	.06	.05 (.08)	.01 (.03)		0
2 2 1	283	251	32	1.33	1.18 (1.75)	.15 (.46)		0
3 2 1	2327	1930	397	10.92	9.06 (13.47)	1.86 (5.69)	Mismatch Only	4
1 1 2	168	100	68	.79	.47 (.70)	.32 (.97)		0
2 1 2	379	137	242	1.78	.64 (.96)	1.14 (3.47)		0
3 1 2	5299	1987	3312	24.87	9.32 (13.86)	15.55 (47.48)	Low Income Only	3
1 2 2	145	133	12	.68	.62 (.93)	.06 (.17)	Low Hours Only	1
2 2 2	1459	1209	250	6.85	5.67 (8.44)	1.18 (3.58)	Excess Hours Only	2
3 2 2	10608	8262	2346	49.77	38.77 (57.63)	11.00 (33.62)	Not Incongruent	5
	21310	14333	6977	100.00	67.26 (100.00)	32.74 (100.00)		
Percentage with only one type of occupational incongruity				93.1	63.5 (94.3)	29.6 (90.5)		
Percentage with multiple occupational incongruity				6.9	3.8 (5.7)	3.1 (9.5)		
Percentage with low hours who are low hours only				42.2	38.7 (51.2)	3.5 (14.3)		
Percentage with excess hours who are excess hours only				67.6	56.0 (74.9)	11.6 (45.9)		
Percentage with low income who are low income only				81.8	30.8 (78.3)	51.0 (84.1)		
Percentage with educational mismatch who are educational mismatch only				71.6	59.4 (77.0)	12.2 (53.1)		

workers are in low hours type only, that 67.6 percent of excess hours workers are in excess hours type only, that 81.8 percent of low income workers are in low income type only, and that 71.6 percent of educationally mismatched workers are in educational mismatch only. Apparently, the low income type is a distinct type from other types, since there is less tendency for a low income worker to be simultaneously occupationally incongruent in other types of occupational incongruity. In contrast, the low hours type seems not to be a distinct type from other types, because there is a marked tendency for low hours workers to be incongruent in other types as well, particularly female workers.

The aggregate rates of occupational incongruity are presented in Table 2. Approximately 1.6 percent of the total employed workers in 1981 were occupationally incongruent in the low hours type, 10.1 percent were in the excess hours type, 30.4 percent were low income, and 15.3 percent were educationally mismatched. Comparing male workers with female workers reveals marked sex differences in the types of occupational incongruity. Male workers are about three times (1.22/.39, 7.57/2.56, 11.76/3.50) as likely to be occupationally incongruent as female workers, with the exception of the low income type. In contrast, female workers are about 1.5 times as likely to be in the low income type of occupational incongruity as male workers. Examining male workers and female workers separately, over fifty percent of employed women are in the low income type, compared to 17.7 percent for employed men. Low hours constitute less than 2 percent of male and female workers. Compared to the other three types, low hours incongruity seems to occur quite infrequently in the labor market.

Table 2. Aggregate Rate of Occupational Incongruity

Type of Occupational Incongruity	Percent		
	Total	Male	Female
Low Hours	1.61	1.22 (1.81)	.39 (1.20)
Excess Hours	10.13	7.57 (11.26)	2.56 (7.86)
Low Income	30.38	11.91 (17.70)	18.47 (56.44)
Mismatch	15.26	11.76 (17.48)	3.50 (10.71)

THE CLASS STRUCTURES OF OCCUPATIONAL INCONGRUITY

To search for an appropriate latent structure model which can explain the observed relationships among the A, I, and M manifest variables of occupation incongruity, some latent structure models are fitted to the data and the likelihood-ratio chi-square (L^2), Pearson's goodness-of-fit chi-square (X^2), and the index of dissimilarity obtained from the model are presented in Table 3. Both chi-square statistics provide a basis to evaluate the adequancy of the large-sample approximations. When the two statistics yield different conclusions, it indicates that the sample is not large enough to justify the adequancy of the model's fit. For very large samples it has been shown that L^2 is superior to X^2.[1] A baseline model H0 assumes that T=1 in equation (1), i.e., there is only one latent class, and is identical to the hypothesis of mutual independence among the manifest variables. The likelihood-ratio chi-square statistics for independent models are L^2(H0)=265.96 and X^2(H0)=274.29 for male workers and L^2(H0)=115.58 and X^2(H0)=114.11 for female workers both on 7 degrees of freedom. It can be concluded that one-class model of independence does not provide a reasonable fit for either sex. It means that the hypothesis, workers can be viewed as an homogeneous aggregated class, is not acceptable.

The six-class latent structure model corresponding to H1 can now be considered. Suppose that the labor market consists of six distinct "intrinsic type" or "latent classes" of workers. For convenience, these are labelled as type 0, 1, . . . , 5 (see Table 1). The zeroth type corresponds to workers who are "intrinsically unscalable" with respect to occupational incongruity. For some workers in this intrinsic class, the types of occupational incongruity are not distinct at all, and any possible combinations of the types of occupational incongruity is possible. The first through the fifth intrinsic types correspond to workers who are intrinsically scalable with respect to distinct scale type or latent class of occupational incongruity. The first class corresponds to workers who are intrinsically incongruent in low hours, the second to workers who are incongruent in excess hours, the third to workers who are incongruent in low income, the fourth to those who are educa-

[1] For further discussion, see Clogg (1979, Pp. 292-3, note 2) or Goodman (1973, p. 1156, note 31).

Table 3. Chi-square Values for Some Latent Structure Models

Hypothesis	Description	Likelihood-Ratio Chi-square L^2	Goodness-of-fit Chi-square X^2	Degrees of Freedom df[a]	Index of Dissimilarity	$1-\frac{L^2(Hi)}{L^2(H0)}$
		Male				
H0	Independence Model	265.96	274.29	7	--	--
H1 (=H2)	Restricted 6-class Model	156.99	163.07	3	0.0088	0.4097
H3	Unrestricted 2-class Model	11.07	10.59	3[b]	0.0067	0.9584
H4	2-class Model with $\pi_{12}^{\bar{A}X}=0$ and $\pi_{22}^{\bar{I}X}=1$	10.96	10.46	4	0.0066	0.9588
H5	2-class Model with $\pi_{11}^{\bar{I}X}=1$ and $\pi_{22}^{\bar{I}X}=1$	17.02	14.58	4	0.0053	0.9360
		Female				
H0		115.58	114.11	7	--	--
H1 (=H2)		35.61	36.10	3	0.0050	0.6919
H3		3.86	3.63	2	0.0039	0.9666
H6	2-class Model with $\pi_{11}^{\bar{I}X}=1$	3.83	3.61	3	0.0039	0.9688

[a] Degrees of freedom=(12-1)-(no. of nonredundant parameters being estimated)+(no. of nonredundant restrictions).

[b] Degrees of freedom are actually 2 for this unrestricted model, but since $\hat{\pi}_{12}^{\bar{A}X}=0$, the large sample theory would not pertain to the unrestricted model for these data. Thus H3 is considered as the restricted model, where $\pi_{12}^{\bar{A}X}$ is set equal to zero. For the restricted model there are 3 d.f., and this restricted model could be tested with usual large sample theory (see Clogg, 1979b, p. 294).

tionally mismatched, and the fifth to workers who are not intrinsically incongruent.

For workers of these intrinsic scale types, their responses to the indicators A, I, and M will correspond to a distinct type of occupational incongruity with certainty. For example, a worker who is intrinsically incongruent in low hours, a worker in the first latent class, will be observed as being occupational incongruent in the low hours type and will not be observed in any other kind of scale types with certainty. An intrinsically scalable worker is one who is at 100 percent risk of the given distinct type of occupational incongruity. A worker in the fifth latent class, corresponding to those who are not instrinsically incongruent, is observed as not being occupationally incongruent with certainty. That is, workers in this fifth type have zero risk of occupational incongruity. Therefore, in addition to usual restrictions for the latent structure model, an additional five restrictions should be imposed to the unrestricted six-class latent structure model. These five restrictions are imposed to constrain intrinsically scalable workers observed in the corresponding latent class with probability 1. The detailed formula are discussed by Clogg (1979a, 90-91).

The six-class latent structure model is proposed to examine whether the labor market consists of six distinct "intrinsic types" or "latent classes" of workers. After fitting the model with five restrictions imposed, it is found that the proportion intrinsically occupationally incongruent in the low hours, $\hat{\pi}^X_3$, is approaching zero (see Table 5 and 6). This indicates that low hours type of occupational incongruity is not distinct, because there are not intrinsic type of workers in a distinct type of low hours. Thus, a modified model H2, five-class latent structure model, which holds H1 and constrains π^X_3 to zero, is considered next. With L^2 (H2)=156.99 and X^2 (H2)=163.07 for male workers, and L^2 (H2)=35.61 and X^2 (H2)=36.10 for female workers both on 3 degrees of freedom, we can tentatively conclude that the five-class latent structure model provides an unacceptable fit to the data for both sexes. The magnitudes of both X^2 statistics are influenced by the sample size, thus sometimes we find that both X^2 statistics are large, yet the model fits the data quite well for a very large sample such as the one used for this study. In this stituation, the index of dissimilarity can provide an alternative basis for evaluating the model fitting.

From Table 3, the index of dissimilarity of this model (H2) shows that the model fits the data well for either male workers or female workers. Only 0.9 percent of male workers (i.e., 129 male workers) and only 0.5 percent of female workers (i.e., 49 female workers) need to be redistributed to obtain the same distribution between observed and expected frequencies. For purpose of understanding how well this model is fitted, the observed and expected frequencies under the five-class latent structure model H2 are presented in Table 4. Clearly, multiple occupational incongruity is not predicted very well by the model, because the standardized residuals corresponding to cells of multiple occupational incongruity are not small.

In detail, Tables 5 and 6 report the latent class parameter estimates, for male workers and female workers, respectively. Model H2 provides the information to characterize the latent classes according to the perspective of intrinsic scale types. For male workers (see Table 5) the intrinsically scalable proportion estimated by model H2 is 0.486 (1-0.514) while the observed scalable proportion is 0.493 (see Table 1). This subtantial difference is attributed to the joint types of occupational incongruity. It is also found that intrinsic occupational incongruity in the excess hours type is estimated to occur with probability 0.039; that intrinsic occupational incongruity in the low income type is estimated to occur with probability 0.071; and that intrinsic occupational incongruity in the educational mismatch type is estimated to occur with probability 0.059. These findings indicate that excess hours, low income, and educational mismatch types seem to emerge as the distinct types of occupational incongruity for male workers.

Besides, the estimated proportion of male workers who are not occupationally incongruent in any type is 0.316. Hence, it can be concluded that 31.6 percent of male workers are at zero risk of occupational incongruity. The observed proportion of workers who are not occupationally incongruent is 0.576, and the difference between the estimated proportion and the observed proportion is due to the random assignment of workers in the zeroth latent class or intrinsically unscalable class. As Clogg (1979a, p.95) noted, intrinsically unscalable workers are a very special part of the labor force. And they are very marginal with respect to the risk of being occupationally congruent. Overall, they have very high risks of being occupationally incongruent.

Table 4. Observed and Expected Frequencies and Standardized Residuals for 5-class Latent Structure Model H2

A-I-M	Meaning	Observed Frequency		Expected Frequency		Standardized Residual	
		Male	Female	Male	Female	Male	Female
1 1 1		16	2	11.99	6.12	1.16	-1.67
2 1 1		17	21	48.67	31.13	-4.54	-1.82
3 1 1		280	293	279.75	292.81	0.02	0.01
1 2 1		11	2	46.37	3.27	-5.19	-0.70
2 2 1		251	32	188.18	16.65	4.58	3.76
3 2 1	Mismatch Only	1930	397	1930.04	397.00	0.00	0.00
1 1 2		100	68	41.43	48.61	9.10	2.78
2 1 2		137	242	168.13	247.21	-2.40	-0.33
3 1 2	Low Income Only	1987	3312	1987.03	3312.12	0.00	0.00
1 2 2		133	12	160.20	26.00	-2.15	-2.75
2 2 2	Excess Hours Only	1209	250	1209.02	250.00	0.00	0.00
3 2 2	Not Incongruent	8262	2346	8262.19	2346.07	0.00	0.00

Table 5 also presents the conditional probabilities corresponding to the marginal distributions of A, I, and M in the intrinsically unscalable type for male workers. These enable us to understand the structure of occupational incongruity in the intrinsically unscalable class. As shown in Table 5, 3.5 percent of the intrinsically unscalable male workers are occupational incongruent in low hours; 14.3 percent in excess hours; 20.6 percent in low income; and 22.4 percent educationally mismatched.

Table 5. Parameter Estimates for Latent Structure Model H2, Male Workers

Scale type	Meaning	Observed	Expected under H2
A. Proportion in the scale types			
0	Unscalable type	0.057	$0.514 = \hat{\pi}^{X}_{0}$
1	Low Hours Only	0.009	$0.000 = \hat{\pi}^{X}_{1} = \pi^{X}_{1}$.
2	Excess Hors Only	0.084	$0.039 = \hat{\pi}^{X}_{2}$
3	Low Income Only	0.139	$0.071 = \hat{\pi}^{X}_{3}$
4	Mismatched Only	0.135	$0.059 = \hat{\pi}^{X}_{4}$
5	Not Incongruent	0.576	$0.316 = \hat{\pi}^{X}_{5}$

B. Risk characteristics of the "intrinsically unscalable"

$\hat{\pi}^{\bar{A}X}_{10} = 0.035$ (3.5% of the "intrinsically unscalable" are occupationally incongruent in low hours.)

$\hat{\pi}^{\bar{A}X}_{20} = 0.143$ (14.3% of the "intrinsically unscalable" are occupationally incongruent in excess hours.)

$\hat{\pi}^{\bar{A}X}_{30} = 0.882$

$\hat{\pi}^{\bar{I}X}_{10} = 0.206$ (20.6% of the "intrinsically unscalable" are occupationally incongruent in low income.)

$\hat{\pi}^{\bar{I}X}_{20} = 0.794$

$\hat{\pi}^{\bar{M}X}_{10} = 0.224$ (22.4% of the "intrinsically unscalable" are occupationally incongruent in Mismatch.)

$\hat{\pi}^{\bar{M}X}_{20} = 0.776$

Table 6. Parameter Estimates for Latent Structure Model H2, Female Workers

Scale type	Meaning	Observed	Expected under H2
A. Proportion in the scale types			
0	Unscalable type	0.095	$0.649 = \hat{\pi}^{X}_{0}$
1	Low Hours Only	0.002	$0.000 = \hat{\pi}^{X}_{1} = \pi^{X}_{1}$
2	Excess Hors Only	0.036	$0.017 = \hat{\pi}^{X}_{2}$
3	Low Income Only	0.474	$0.141 = \hat{\pi}^{X}_{3}$
4	Mismatched Only	0.057	$0.034 = \hat{\pi}^{X}_{4}$
5	Not Incongruent	0.336	$0.158 = \hat{\pi}^{X}_{5}$

B. Risk characteristics of the "intrinsically unscalable"

$\hat{\pi}^{\bar{A}X}_{10} = 0.019$ (1.9% of the "intrinsically unscalable" are occupationally incongruent in low hours.)

$\hat{\pi}^{\bar{A}X}_{20} = 0.094$ (9.4% of the "intrinsically unscalable" are occupationally incongruent in excess hours.)

$\hat{\pi}^{\bar{A}X}_{30} = 0.887$

$\hat{\pi}^{\bar{I}X}_{10} = 0.652$ (65.2% of the "intrinsically unscalable" are occupationally incongruent in low income.)

$\hat{\pi}^{\bar{I}X}_{20} = 0.348$

$\hat{\pi}^{\bar{M}X}_{10} = 0.112$ (11.2% of the "intrinsically unscalable" are occupationally incongruent in mismatch.)

$\hat{\pi}^{\bar{M}X}_{20} = 0.888$

Because the low hours type is not a distinct type of occupational incongruity, the unscalable class should include all workers who are observed in the low hours type of occupational incongruity under model H2. However, due to the very small proportion of workers that are occupationally incongruent in the low hours type, only 3.5 percent of the zeroth latent class workers are occupationally incongruent in the low hours type. But this does not mean that the intrinsically unscalable class has a low risk in the low hours type of occupational incongruity. All of these imply that the intrinsically unscalable class has high risk of being in one of the four different types of occupational incongruity.

For female workers (see Table 6), the estimated proportion of intrinsically unscalable class under H2 is 0.649. Only 15.8 percent of female workers are at zero risk of occupational incongruity which is about half that for male workers. Female workers in the excess hours type are estimated to occur with a probability 0.036 which is half that for male workers. However, intrinsic occupational incongruity of the low income type is estimated to occur with a probability twice that of male workers. Finally, the estimated probability of incongruity in educational mismatch for female workers (0.034) is lower than that of male workers (0.059). These findings indicate that there are different latent structures of occupational incongruity for male and female workers, which also reflect the differential patterns of observed occupational incongruity. As shown in Table 6, 1.9 percent of the intrinsically unscalable class of female workers are occupationally incongruent in the low hours type; 9.4 percent in the excess hours type; 65.2 percent in the low income type; and 11.2 percent in the educational mismatch type. These result also imply that the intrinsically unscalable class of female workers has high risk of occupational incongruity, particularly in the low income type.

Consider next the unrestricted two-class latent structure model H3 in which T=2 in equation (1). With L^2 (H3)=11.07 and X^2 (H3)=10.59 on 3 d.f. for male workers and L^2 (H3)=3.86 and X^2 (H3)=3.63 on 2 d.f. for female workers, these models are acceptable. From Table 3, it is also indicates that H3 accounts for about 96 percent of the variation in the data. This model fits the data very well for male workers and female workers separately. It should be noted that the model for male workers gains one degree of freedom because an estimated conditional probability is approaching zero (see Table 8). Also, the index of dissimilarity under H3 shows that the difference between expected and observed frequencies is quite small in both male and female models.

Model H4 through H6 impose different restrictions on the unrestricted two-class latent structure model H3. After fitting the data, it is found that model H4 and model H6 are acceptable and model H5 is rejected on statistical grounds. However, it is clear that model H5 accounts for about 94 percent of the variation in the data. Model H4 indicates that the second latent class of male workers has zero risk at low hours type and low income type occupational incongruity. Model H5 exhibits the first latent class of male workers is occupationally incongruent in low income with probability 1 and the second latent class of male workers has zero risk at low income type of occupational incongruity. Model H6 expresses that the first latent class of female workers has 100 percent risk at low income type of occupational incongruity. All these models suggest that the first latent class of workers seems to have a very high risk of being occupationally incongruent in the low income type.

SEX DIFFERENCES IN LATENT STRUCTURES OF OCCUPATIONAL INCONGRUITY

Table 7 presents degrees of freedom and X^2 statistics for some simultaneous two-class latent structures applied to male workers (group 1) and female workers (group 2) in Table 1. Both likelihood-ratio chi-square and Pearsons' goodness-of-fit chi-square are presented. Model M1 is the heterogeneous, unrestricted two-class latent structure and it says that two groups are completely heterogeneous in the latent structures. It is actually equivalent to applying the unrestricted two-class model separately to each of two groups. With $L^2(M1)=14.90$ on 5 d.f., the model fits the data well. Aso, $L^2(M1)$ and degrees of freedom of model M1 are found to equal the sum of $L^2(H3)$ of the male workers' model and female workers' model, respectively, and the sum of the corresponding degrees of freedom, listed in Table 3. The parameter estimates for M1 expressed as a restricted four-class model for the four-way contingency table appear in Table 1. The parameter estimates have been converted into the corresponding parameter values for the simultaneous latent structure and are reported in Table 8 which provides the information to characterize the latent classes.

When considering parameter values for male workers, it shows that latent class 1 is estimated to occur with probability 0.376 and from the conditional

Table 7. Chi-square Values of Some Simultaneous Latent Class Models for Male-Female Comparison

Hypothesis	Description	Degrees of Freedom df*	Likelihood-Ratio Chi-square L^2	Goodness-of-fit Chi-square X^2
M1	Unrestricted 2-class 2-group Model	5[a]	14.90	14.21
M2	Imposing Homogeneity on the Latent Class Proportions	5	15.48	14.67
M3	Imposing Homogeneity on All Conditional Probabilities	12	141.22	138.53
M4	Imposing Homogeneity on the Latent Class and on All Conditional Probabilities	16[c]	3789.25	3977.23
M5	Imposing Homogeneity on the Latent Class Proportion and on Conditional Probabilities of A and M	13[b]	487.63	495.53
M6	Imposing Homogeneity on the Latent Class Proportion and on Conditional Probability of A	9	96.48	92.42

* Degrees of freedom = 2(12-1)-2 (no. of nonredundant parameters being estimated) +(no. of nonredundant restrictions).

[a] Gains one degree of freedom due to one estimator approaching zero. See comments in note b in Table 3.

[b] Gains two degrees of freedom due to two estimators approaching zero. See comments in note b in Table 3.

[c] Gains three degrees of freedom due to three estimators approaching zero. Also see comments in note b in Table 3.

Table 8. Parameter Estimates for Simultaneous Latent Class Model M1

Latent Class Proportions			
Male Workers		Female Workers	
$\hat{\pi}^{G\bar{X}}_{11} = 0.376$		$\hat{\pi}^{G\bar{X}}_{21} = 0.321$	
$\hat{\pi}^{G\bar{X}}_{12} = 0.624$		$\hat{\pi}^{G\bar{X}}_{22} = 0.679$	

	Conditional Probabilities			
	G=1, Male Workers		G=2, Female Workers	
	Latent Class 1	Latent Class 2	Latent Class 1	Latent Class 2
$\hat{\Pi}^{\bar{A}GX}_{1st}$	0.048	0.000	0.028	0.004
$\hat{\pi}^{\bar{A}GX}_{2st}$	0.060	0.144	0.049	0.092
$\hat{\pi}^{\bar{A}GX}_{3st}$	0.892	0.856	0.923	0.904
$\hat{\pi}^{\bar{I}GX}_{1st}$	0.461	0.006	0.995	0.361
$\hat{\pi}^{\bar{I}GX}_{2st}$	0.539	0.994	0.005	0.639
$\hat{\pi}^{\bar{M}GX}_{1st}$	0.121	0.207	0.033	0.142
$\hat{\pi}^{\bar{M}GX}_{2st}$	0.879	0.793	0.967	0.858

probabilities this class appears to be associated with low hours and low income types of occupation incongruity. Latent class 2 is estimated to occur with probability 0.624 and tends to be associated with excess hours and educational mismatch types of occupational incongruity. It also exhibits zero risk at low hours type and very low risk at low income type of occupational incongruity.

When checking parameter values for female workers, it is also shows that 32.1 percent of female workers can be thought of as being in latent class 1, and 67.9 percent can be regarded as latent class 2. The conditional probabilities of female workers signify that latent class 1 is associated with low income and low hours. Latent class 1 of female workers has almost a 100 percent risk of low income incongruity. Latent class 2 of female workers tends to express excess hours and educational mismatch types of occupational incongruity. These parameter values provide a clear picture of the latent structures indirectly observed in both male and female workers.

Models M2 to M6, derived from M1 by imposing different homogeneity constraints, provide a basis to test the across-group equality hypothesis. Model M2 impose the homogeneity constraints on the latent class proportions and it has one more degree of freedom than M1 in general. (However, M1 here gains on more degree of freedom due to estimated parameter value $\dot{\pi}^{\bar{A}GX}_{112}$ approaching zero.) This model says that the latent class proportions are the same across groups. This model fits the data well. The conditional test statistic, $L^2(M2|M1)=L^2(M2)-L^2(M1)=0.58$ on 1 d.f., indicates that the constraint, which are the same latent class proportions between male workers and female workers, is acceptable.

Model M3 imposes homogeneity on all conditional probabilities and it has 8 more degrees of freedom than M1 in general. This model says that two groups are partially homogeneous in conditional probabilities only. In other words, this constraint means that male workers and female workers have the same risks of being in each of the four different types of occupational incongruity. With $L^2(M3)=141.22$ on 12 d.f., it leads to a rejection of this model. Further, the comparison between M3 and M1, based upon the conditional test statistic $L^2(M3|M1)=L^2(M3)-L^2(M1)=126.32$ on 8 d.f., indicates that this constraint is not suitable.

Model M4 impose homogeneity on the latent class proportions and on all conditional probabilities to M1 simultaneously. This model expresses that male and female workers are completely homogeneous in latent structures. Apparently, this model is rejected because its L^2 equals 3789.25 on 16 d.f.. Therefore, this constraint is not suitable and leads to the conclusion that male workers and female workers are not completely homogeneous groups in terms of the latent structures of occupational incongruity. In order to further search for the differences of latent structures between male workers and female workers, models M5 and M6 are considered next.

Models M5 to M6 successively impose other across-group homogeneity constraints on the conditional probabilities and latent class proportions. Models M5 imposes homogeneity on the latent class proportions and on conditional probabilities of A and M. Model M6 imposes homogeneity on the latent class proportions and on conditional probabilities of A only. The conditional test statistic L^2 (M4|M5)=3301.62 on 16-13=3 d.f. suggests that male workers have very different risks of low income incongruity from female workers. Also, the conditional test statistic, L^2 (M5|M6)=391.15 on 4 d.f., shows that the risk of occupational incongruity in educational mismatch is different between male workers and female workers. Further, the conditional test statistic, L^2 (M6|M2)=81.0 on 4 d.f., indicates that the risks of low hours and excess hours types of occupational incongruity also differ between male workers and female workers.

In sum, the latent proportions are homogeneous between male and female workers. That is, the "class distribution" is the same for males and females. However, the relationships between manifest variables A, I, and M and the latent factor X are all different between two groups. In other words, male workers and female workers have different risks of being in the four types of occupational incongruity.

SUMMARY AND DISCUSSION

The major objective of this study was to examine the latent structure of occupational incongruity and sex differences in latent structure for Taiwan's labor force. The data used for this study was taken from a cross-sectional survey with data on labor utilization of Taiwan's labor force. The results of the examination of the distribution of occupational incongruity revealed that male workers were more likely to be incongruent in low hours, excess hours, and educational mismatch than female workers. However, female workers were more likely to be in the low income type of incongruity. In terms of the class structure of occupational incongruity, workers cannot be viewed as an homogeneous aggregated class. More comprehensive analyses of the class structure of occupational incongruity suggested that the low hours type was not distinct from the other types for both male and female workers. Stated differently, it was found that excess hours, low income, and educational mismatch were distinct types of incongruity for male and female workers. The risks of there being different distinct types of occupational incongruity for male workers were different from those for female workers.

An examination of the unrestricted two-class latent structure model indicated that the first latent class tended to be strongly associated with low income incongruity for both males and females; that the second class tended to express excess hours or educational mismatch incongruity for both sexes. These similarities and differences in the latent class structure between males and females can be seen most clearly in the findings on the simultaneous latent structure models. The latent class proportions were found to be homogeneous between males and females. However, male workers and females workers had different risks of experiencing in the low hours, excess hours, low income, and educationally mismatched types of occupational incongruity.

Because the same criterion has been employed for distinguishing low income workers and female workers were found having high risks to be occupational incongruity in low income type, it could be concluded that in general female workers have less income than male workers received in the labor market.

The findings point to several limitations of research that ignores trend patterns of occupational incongruity. Changes in occupational incongruity over time mask how labor market outcomes vary with business cycle or national economy, cohort size, and age group. Although existing labor utilization statistics show a trend in unemployment and underemployment, changes in class distribution and class structure over time will provide more dynamic processes of labor market. To understanding the dynamic processes of manpower utilization in the labor market, longitudinal data set are necessary for future research.

In addition, more attention should give to latent structure of occupational incongruity in different types of labor market such as industry, occupation, and ecological types of labor markets, etc. Moreover, how latent structure of occupational incongruity change over time is also important..

Additional research could profitably take up the issue of consequences of occupational incongruity either from psychological aspect or socioeconomic aspect. Greater attention to this issue might expand the understanding of life chance of workers who have occupational incongruity.

Latent structure models and methods are attractive for many problems in labor force study and in labor mobility. Simultaneous latent structure models enable researchers to deal with many practical across-group comparison problems. Evidences show that these statistical methods are very appealing, since they are related to probabilities which describe the relationship between latent variable and observed discrete data. They are therefore offered as a potentially fruitful tool for pursuing the agenda for manpower utilization and manpower mobility.

Most important, more research on the causes of occupational incongruity, including involuntary part-time work, low income work, and educationally mismatched work, is needed so that policies can be formulated to improve manpower utilization, to adjust the educational programs, or to enhance manpower planning.

REFERENCES

Averitt, R. T.
1968 The Dual Economy: The Dynamics of American Industry Structure. New York: W. W. Norton & Co., Inc.

Becker, G. S.
1965 "A Theory of the Allocation of Time." Economic Journal 75: 493-517.

Becker, G. S.
1975 Human Capital Second Edition. New York: National Bureau of Economic Research, Columbia University Press.

Ben-Porath, Y.
1967 "The Production of Human Capital and the Life Cycle of Earnings." Journal of Political Economy 75: 352-365.

Berg, I.
1970 Education and Jobs: The Great Training Robbery. New York: Praeger.

Berk, R. A. and S. F. Berk
1983 "Supply-side Sociology of the Family: The Challege of the New Home Economics." Annual Review of Sociology 9: 375-395.

Blau, P. M. and O. D. Duncan
1967 The American Occupational Structure. New York: Wiley.

Blinder, A. S. and Y. Weiss
1976 "Human Capital and Labor Supply: A Synthesis." Journal of Political Economy 84: 449-472.

Bluestone, B.
1970 "The Tripartite Economy: Labor Markets and the Working Poor." Poverty and Human Resources 5: 15-35.

Breiger, R. L.
1981 "The Social Class Structure of Occupational Mobility." American Journal of Sociology 87: 578-611.

Burris, V.

1983 "The Social and Political Consequences of Overeducation." <u>American Sociological Review</u> 48: 454-467.

Carter, K. A.

1982 "Inadequacies of the Traditional Labor Force Framework for Rural Areas: A Labor Utilization Framework Applied to Survey Data." <u>Rural Sociology</u> 47: 459-474.

Chang, P. C.

1981 "Human Resources and Development in Taiwan, R. O. C." <u>Industry of Free China</u> 51: 15-29.

Clogg, C. C.

1977 "Unrestricted and Restricted Maximum Likelihood Latent Structure Analysis: A Manual for Users." <u>Working Paper</u> 1977-09. University Park: Population Issues Research Center, Pennsylvania State University.

Clogg, C. C.

1979a <u>Measuring Underemployment: Demographic Indicators for the United States.</u> New York: Academic Press.

Clogg, C. C.

1979b "Some Latent Structure Models for the Analysis of Likert Type Data." <u>Social Science Research</u> 8: 287-301.

Clogg, C. C.

1980 "Characterizing the Class Organization of Labor Market Opportunity: A Modified Latent Structure Approach." <u>Sociological Methods and Research</u> 8: 243-272.

Clogg, C. C.

1981a "A Comparison of Alternative Models for Analyzing the Scalability of Response Patterns." Pp. 240-280 in S. Leinhardt (ed.), <u>Sociological Methodology</u> 1981. San Francisco: Jossey-Bass.

Clogg, C. C.

1981b "New Developments in Latent Structure Analysis." Pp. 215-246 in D. M. Jackson and E. F. Borgatta (eds.), <u>Factor Analysis and Measurement in Sociological Research</u>. Beverly Hill: Sage.

Clogg, C. C.

1981c "Latent Structure Models of Mobility." American Journal of Sociology 86: 836-868.

Clogg, C. C.

1984 "Some Statistical Models for Analyzing Why Surveys Disagree." In C. F. Turner and E. Martin (ed.), Surveying Subjective Phenomena. New York: Basic Books.

Clogg, C. C. and L. A. Goodman

1984 "Latent Structure Analysis of a Set of Multidimensional Contingency Tables." Journal of the American Statistical Association 79: 762-771.

Clogg, C. C. and L. A. Goodman

1985 "Simultaneous Latent Structure Analysis in Several Groups." Pp. 81-110 in N. B. Tuma (ed.), Sociological Methodology, 1985. San Francisco: Jossey-Bass.

Clogg, C. C. and J. M. Munch

1984 "Using Simultaneous Latent Structure Models to Analyze Group Differences: Exploratory Analysis of Buying Style Items." Journal of Business Research 12: 319-336.

Clogg, C. C. and J. W. Shockey

1984 "Mismatch Between Occupation and Schooling: A Prevalence Measure, Recent Trends and Demographic Analysis." Demography 21: 235-257.

Clogg, C. C. and T. A. Sullivan

1983 "Labor Force Composition and Underemployment Trends, 1969-1980." Social Indicators Research 12: 117-152.

Doeringer, P. B. and M. J. Piore

1971 Internal Labor Markets and Manpower Analysis. Lexington, Mass: Heath.

Fleisher, B. M. and T. J. Kniesner

1980 Labor Economics: Theory, Evidence, and Policy. Second Edition. Englewood Cliffs, N. J.: Prentice-Hall, Inc.

Fienberg, S. E.

1980 The Analysis of Cross-classified Categorical Data. Cambridge: The MIT Press.

Freeman, R. B.

1975 "Overinvestment in College Training.: Journal of Human Resources 10: 287-311.

Freeman, R. B.

1976 The Overeducated American. New York: Academic Press.

Freeman, R. B.

1980 "The Facts About the Declining Economic Value of College." Journal of Human Resources 15: 124-142.

Goodman, L. A.

1974a "The Analysis of System of Qualitative Variables When Some of the Variables Are Unobservable, Part I– A modified Latent Structure Approach." American Journal of Sociology 79: 1179-1259.

Goodman, L. A.

1974b "Exploratory Latent Structure Analysis Using Both Identifiable and Unidentifiable Models." Biomtrika 61: 215-231.

Gordon, D. M.

1972 Theories of Poverty and Underemployment. Lexington, Mass: Heath.

Gronau, R.

1977 "Leisure, Home Production, and Work– The Theory of the Allocation of Time Revisited." Journal of Political Economy 85: 1099-1124.

Hauser, P. M.

1974 "The Measurement of Labor Utilization." Malayan Economic Review 19: 1-17.

Hauser, P. M.

1977 "The Measurement of Labor Utilization– More Empirical Results." Malayan Economic Review 22: 10-25.

Hodson, R. D.

1978 "Labor in the Monopoly, Competitive and State Sectors of Production." Politics and Society 8: 429-80.

Hou, C. M.

1975 "Manpower Utilization and Labor Mobility in Taiwan." Industry of Free China 45: 2-30.

Jovanovic, B.

1979 "Firm-Specific Capital and Turnover." Journal of Political Economy 87: 1246-1260.

Kalleberg, A. L. and A. B. Sorensen

1979 The Sociology of Labor Markets. Annual Review of Sociology 4: 351-379.

Liu, K. C.

1982 "Labor Mobility and Utilization in Relation to Urbanization in Taiwan, Part II." Industry of Free China 52: 7-17.

Marsden, P. U.

1985 "Latent Structure Models for Relationally Defined Social Classes." American Journal of Sociology 90: 1002-1021.

Michael, R. T. and G. S. Becker

1973 "On the New Theory of Consumer Behavior." Swedish Journal of Economics 75: 378-296.

Mincer, J.

1974 Schooling, Experience, and Earnings. New York: National Bureau of Economic Research, Columbia University Press.

O'Connor, J. R.

1973 The Fiscal Crisis of the State. New York: St. Martin's Press.

Osterman, P.

1975 "An Empirical Study of Labor Market Segmentation." Individual Labor Relation Review 28: 508-523.

Piore, M. J.

1973 "Fragments of a Sociological Theory of Wages." American Economic Review 63: 377-384.

Pollak, R. A. and M. L. Wachter

1975 "The Relevance of the Household Production Function and Its Implications for the Allocation of Time." Journal of Political Economy 83: 255-277.

Rumberger, R. W.

1981 Overeducation in the U. S. Labor Market. New York: Praeger.

Scott, W. R.

1981 Organizations: Rational, Natural, and Open Systems. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Schultz, T. W.

1961 "Investment in Human Capital." American Economic Review 51: 10-17.

Sobel, I.

1982 "Human Capital and Institutional Theories of the Labor Market: Market: Rivals or Complements." Journal of Economic Issues 16: 255-272.

Stokes, C. S. and Y. S. Hsieh

1983 "Female Employment and Reproductive Behavior in Taiwan, 1980." Demography 20: 313-331.

Sullivan, T. A.

1978 Marginal Workers, Marginal Jobs: The Underutilization of American Workers. Austin: University of Texas Press.

Thurow, L. G.

1975 Generating Inequality. New York: Basic Books.

Tipps, H. C. and H. A. Gordon

1985 "Inequality at Work: Race, Sex and Underemployment." Social Indicators Research 16: 35-49.

Tolbert, C., P. M. Horan, and E. M. Beck

1980 "The Structure of Economic Segmentation: A Dual Economy Approach." American Journal of Sociology 85: 1095-1116.

臺灣地區就業勞工職業不協調的隱性結構

謝　雨　生*

(中文摘要)

本文探討台灣地區就業勞工職業不協調的隱性結構，也同時比較男女性就業勞工職業不協調之隱性結構上的異同。文中職業不協調包括四個指標：非志願性的部份時間工作者，工作時間過長的工作者，所得低的工作者和教育過度（或教育不配合）的工作者。分析的資料來自 1982 年 5 月行政院主計處勞動調查委員會所進行的勞動力應用調查。群體職業不協調之隱性結構以兩個階層爲佳。第一階層或第一組之勞工，不論是男性或女性，有極高的機會就業於低所得的工作。第二階層之勞工，也不論是男性或女性，則傾向於工作時間過長或教育過度。另外，分析結果顯示男女就業勞工職業不協調的隱性結構分配是相似的，但是男女性勞工却有顯著不同的機率就業於下列的工作：(1)非志願性部分時間工作，(2)工作時間過長的工作，(3)所得低的工作及(4)教育過度的工作。

* 台灣大學農業推廣學系講師

THE LATENT STRUCTURE OF OCCUPATIONAL INCONGRUITY FOR TAIWAN'S LABOR FORECE

(ABSTRACT)

This study employed nationwide survey data to estimate the extent of occupational incongruity for Taiwan's labor force. Specifically, it attempted to examine the latent structure of occupational incongruity and to assess sex differences in the latent structure of occupational incongruity. Four indicators were used to represent occupational incongruity: involuntary part-time work, excess hours work, relatively low income work, and educationally mismatched work. The data suggested that the unrestricted two-class latent class model was appropriate for Taiwan's labor force. The first class tended to be strongly associated with low income incongruity for male workers and female workers. The second class tended to express excess hours or educational mismatch incongruity for both sexes. The class structure of occupational incongruity was examined and compared for male workers and female workers. The results revealed that the latent class proportions were the same between males and females, but the sexes had differential risks of experiencing low hours, excess hours, low income, and educational mismatch. The implications of these results for an understanding of manpower utilization were discussed in the final section.