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A Comparison of LISREL and Two-Stage Least Squares Analysis of a Hypothesized Life–Job Satisfaction Reciprocal Relationship

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The nature of the relationship between life satisfaction and job satisfaction was investigated using both two-stage least squares and the analysis of linear structural equations by LISREL. These techniques were chosen because both provide the possibility of evaluating causal relationships that are bidirectional. The results are consistent with a model that hypothesizes a reciprocal relationship between job and life domains. Further, results concerning estimates of structural parameters were consistent across analysis techniques. Some comparisons and cautionary remarks regarding the use of both techniques are presented.

The interrelationship of job satisfaction and life satisfaction has long been an area of concern in the literature on job attitudes (for reviews see Kabanoff, 1980; Near, Rice, & Hunt, 1980; Rice, Near, & Hunt, 1980). For the most part, the nature of the relationship between job and life satisfaction has been portrayed in terms of three rival hypotheses: (a) that there is a positive relationship; (b) that there is a negative relationship; and (c) that there is no relationship.

The first hypothesis (known as the generalized or spillover model) suggests that satisfaction in one domain of a person's life spills over into other areas. Thus, for example, workers who experience discontentment in their work do not compensate for this lack of psychological gratification by finding satisfaction in other aspects of their life, but rather are more likely to experience a greater incidence of unhappiness in nonwork activities. The spillover model suggests that the causal flow is either from job to life satisfaction or from life to job satisfaction, but not both simultaneously. In contrast, the second hypothesis (known as the compensation model) argues that individuals who have jobs deficient in need fulfillment will compensate for this deficiency by seeking out challenging and interesting nonwork activities. Finally, the third hypothesis (known as the segmentation model) implies that the worlds of work and nonwork are psychologically separate. That is, there is an independence between the activities and feelings in the work and nonwork spheres of people's lives.

An assessment of the considerable body of research that has accumulated in the job–life satisfaction area reveals a wealth of inconsistent empirical results (Near et al., 1980). Neither the spillover, compensatory, or segmentation hypotheses have been verified. Consequently, the nature of the relationship between job satisfaction and life satisfaction is less than clear. The situation gives rise to serious questions about the assumptions incorporated in the models that have been advanced. For instance, both the spillover and compensatory models assume that the causal flow that they hypothesize is unidirectional, ignoring the possibility of a reciprocal linkage. In a deviation from this pattern, Rice et al. (1980) have recently suggested that a mutual, interactive relationship may exist between job satisfaction and life satisfaction. That is to say, that job satisfaction and life satisfaction may be directly, as well as reciprocally related. A reciprocal relationship is defined as one in which the causal flow is bidirectional (see Maruyama & McGarvey, 1980, and Figure 1). If this is indeed true, past empirical tests of the job–life satisfaction relationship that have assumed an unambiguous directionality of ef-

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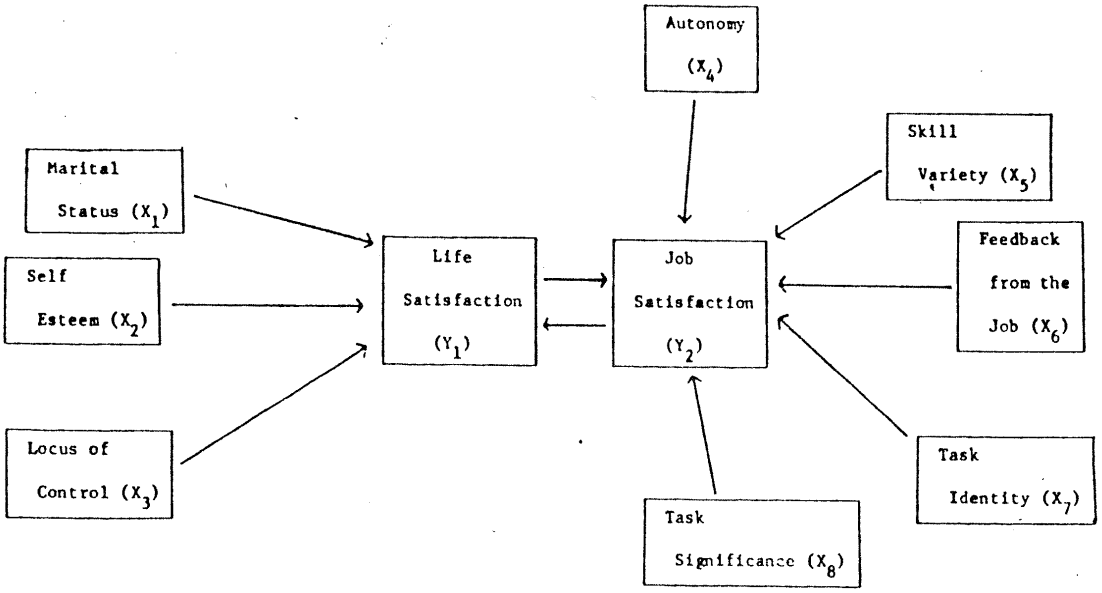

Figure 1. Structural model of the determinants of job and life satisfaction.

fects have inevitably produced results that tell only half the story (Sanders, 1980).

In the present study, our primary purpose was to test the hypothesis of reciprocal causation between job satisfaction and life satisfaction. Since the testing of reciprocity hypotheses is relatively rare in the social sciences, our second purpose is to illustrate the use of two different data analytic strategies designed to test the plausibility of reciprocal causation. These two techniques are two-stage least squares (James & Singh, 1978) and the analysis of linear structural equations by LISREL (Jöreskog & Sörbom, 1978).

The conceptual model tested in this study is presented in Figure 1. This diagram indicates that life satisfaction is determined by marital status, self-esteem, and locus of control, as well as by job satisfaction. Job satisfaction is hypothesized to be the result of the job scope variables (Hackman & Oldham, 1976)—autonomy, skill variety, feedback from the job, task identity, and task significance, as well as life satisfaction. The existence of a positive relationship between life and job satisfaction in either or both directions would be supportive of the spillover hypothesis in that satisfaction in one sphere leads to satisfaction in the other. Determining the relative sizes of the two relationships given that both are significant as well as finding the significance of the difference between the two paths would suggest which causal flow is most predominant. The existence of negative job–life satisfaction relationships in either direction would lend credence to the compensation hypothesis and the absence of any relationship between life and job satisfaction would be consistent with the segmentation hypothesis.

The inclusion of additional determinants of both constructs of primary interest was done for both methodological and conceptual reasons. Both data analytic techniques require the introduction of other causes of both job and life satisfaction for identification purposes. Nontechnically, identification means that the values of some of the parameters in the model are known or conceptualized so that unique estimates of the remaining parameters are possible. A general discussion of identification is presented in Kenny (1979, pp. 34–40) and Jöreskog and Sörbom (1978, pp. 9ff). Conceptually, the model presented in Figure 1 predicts that as a job is perceived as more autonomous, challenging, and important, it will also be more satisfying to the job incumbents. Consistent with the model proposed by James and Jones (1980) and the work of Stone and his colleagues (Stone, 1976; Stone, Mowday, & Porter, 1977), we do not propose any mod-

erators of the job perception–job satisfaction relationship. Of the life satisfaction determinants, marital status has perhaps been most frequently associated with life satisfaction (Rice et al., 1980). Personality correlates of nonwork satisfaction have been less frequently researched (see Kabanoff, 1980; and Champoux, 1981, for reviews), but Champoux (1978) and Bedeian & Marbert (1979) produced evidence that self-concept was a determinant of the usefulness of the spillover or compensatory hypothesis in explaining the job–life satisfaction relationship. In addition, in her review of self-esteem and work, Tharenou (1979) has suggested that self-esteem might more appropriately be treated as an independent variable than as an outcome of work. In the present study, self-esteem was chosen because it seemed reasonable that persons who viewed themselves in a positive manner would be happy with their current life status and that persons of low self-esteem would be dissatisfied. Likewise for locus of control, individuals who feel in control of their lives should be more happy with their life status.

Method

The sample included 873 people who worked in various civil service positions for the State of Michigan. Of the sample, 40% were female; 15% were nonwhite; 42% were unmarried—either never married, single, divorced, or otherwise separated. Their average age was just under 24 and about half reported that they had received some post-high school education. The respondents represented about 40% of those to whom questionnaires were originally sent as part of a study on the work motivation of civil service employees.

Measures

The Gurin, Veroff, and Feld (1960) scale was used to measure general life satisfaction. Respondents to this scale indicate their satisfaction–dissatisfaction on three, 5-point Likert format items: "I generally feel in good spirits," "I am very satisfied with life," and "I find a good deal of happiness in life." In addition, life satisfaction was indexed by questions concerning satisfaction with family and leisure activities. Job perceptions were measured by five subclasses of the Job Diagnostic Survey (Hackman & Oldham, 1976)—Autonomy, Skill Variety, Feedback From the Job, Task Identity, and Task Significance. Subjects answered the short form of the Minnesota Satisfaction Questionnaire (Weiss, Dawis, England, & Lofquist, 1967), which served as the job satisfaction measure. This form yields an intrinsic satisfaction subscale consisting of 12 items concerning the degree of satisfaction with the independence, prestige, and development opportunities afforded by one's job. Items concerning supervision, company policy, and pay comprise the extrinsic satisfaction subscale.

Variables exogenous to life satisfaction included marital status, self-esteem, and locus of control. Self-esteem was measured by Rosenberg's (1965) scale. Rosenberg has reported considerable evidence of this scale's construct validity and reliability. Locus of control was assessed by an 11-item work-related version of Rotter's (1966) scale used in previous research by Andrisani and Nestel (1976) and Schmitt, White, Coyle, and Rauschenberger (1979). Marital status was dichotomous; married persons were coded 2; all others were coded 1.

Data Collection

Data were collected by means of a mailed survey to civil service personnel in the State of Michigan. Approximately 40% (N = 873) returned the questionnaires for which they received a $5.00 honorarium and a brief summary of the study results. No followup effort was possible because of confidentiality assurances.

Data Analysis

Two different data analytic techniques were used to test the reciprocal causality hypothesis suggested by Figure 1. The first of these two analyses, two-stage least squares (2SLS), has been outlined by James and his colleagues (James & Jones, 1980; James & Singh, 1978). The nonrecursive model in Figure 1 involves two endogenous variables (Y_1 and Y_2) and eight exogenous variables (X_1 through X_8). The population path equations for this model are as follows:

$$y_1 = P_{11}X_1 + P_{12}X_2 + P_{13}X_3 + P_{y1y2}Y_2 + \mu_1 ; \quad (1)$$

$$y_2 = P_{24}X_4 + P_{25}X_5 + P_{26}X_6 + P_{27}X_7 + P_{28}X_8 + P_{y2y1}Y_1 + \mu_2 . \quad (2)$$

The 2SLS procedure involved the following steps. First, each endogenous variable was regressed on *all* exogenous variables. Specifically, two ordinary least squares regressions were computed:

$$y_1 = W_{11}x_1 + \cdots + W_{18}x_8 + r_i ; \text{ and} \quad (3)$$

$$y_2 = W_{21}x_1 + \cdots + W_{28}x_8 + r_2 , \quad (4)$$

where the W_{ij} are beta weights and r_i are residuals. Consistent with Hout (1977), all variables were standardized prior to the first-stage least squares analysis. Predicted values of y_1 and y_2 values based on the population beta weights in Equations 3 and 4 above have the important property that they are unrelated to the μ_i in the structural path equations (Equations 1 and 2 above). This is true for sample beta weights only in very large samples. Thus, the first-stage least squares analysis has the function of removing the residual μ_i from the dependent or endogenous variables; or, y_1 and y_2 are purged of their relationship with μ_1 and μ_2.

Second, the predicted values of y_1 and y_2 are computed. Third, the second stage of 2SLS is accomplished by regressing each endogenous variable on the stan-

dardized exogenous and endogenous variables with which it has a direct relationship. However, the endogenous variables that are reciprocally related are replaced with their unstandardized predicted scores from the first-stage equations. The second set of equations that are estimated are expressed below as population equations:

$$y_1 = \beta_{11}x_1 + \cdots + \beta_{13}x_3 + \beta_{y1y2}\hat{y}_2 + e_1\,; \text{ and} \quad (5)$$

$$y_2 = \beta_{24}x_4 + \cdots + \beta_{28}x_8 + \beta_{y2y1}\hat{y}_1 + e_2\,, \quad (6)$$

where the βs represent population path coefficients, e_i are residuals, and $\hat{y}_i$ are unstandardized predicted values.

Use of separate applications of multiple regression requires several precautions with respect to estimates of the path equations for the endogenous variables, and the tests of significance for all path coefficients (Erlanger & Winsborough, 1976; Hout, 1977; James, 1981). Estimates of path coefficients (β_{ij}) for the exogenous variables are correct. The appropriate estimates of the path coefficients for the endogenous variables are obtained by standardizing all variables before the first-stage regressions and using the unstandardized regression weights in the second-stage analyses as estimates of the path coefficients. Appropriate statistical tests are conducted using the following steps. First, new error terms for both equations are computed as follows:

$$\hat{\mu}_1 = y_1 - [\beta_{y1y2}y_2 + \beta_{11}x_1 + \cdots + \beta_{13}x_3]\,; \text{ and} \quad (7)$$

$$\hat{\mu}_2 = y_2 - [\beta_{y2y1}y_1 + \beta_{24}x_4 + \cdots + \beta_{28}x_8]\,. \quad (8)$$

Then the standard error values are computed using Equation 9:

$$SE^{c}_{\beta_{ij}} = SE^{2S}_{\beta_{ij}}\,[S_{e_i}/S_{\hat{\mu}_i}], \quad (9)$$

where $SE^{c}_{\beta_{ij}}$ = the correct error term for a path coefficient; $SE^{2S}_{\beta_{ij}}$ = the standard error term for a β_{ij} provided in the second stage analysis; S_{e_i} = the standard deviation of residuals obtained from the second stage output; and $S_{\hat{\mu}_i}$ = the standard deviation of μ_i obtained by Equations 7 and 8 above. Rationale for this correction to the significance test is provided by Erlanger and Winsborough (1976), Hout (1977), and James, Mulaik, and Brett (Note 1).

Several assumptions inherent in the causal modeling process using data collected at a single point in time, in general, and 2SLS, in particular, should be noted. We assume that the causal effects have occurred rapidly, that the system of relationships among the variables is stable at the time of data collection, and that the directions of causal flow are correctly specified. Linear and additive causal effects are assumed as well as measurement on reasonably interval and reliable scales. Further, the error terms are assumed to be normally distributed with means of zero. As discussed below, we also assume no significant unmeasured variables problems.

Data were also analyzed using LISREL (Jöreskog & Sörbom, 1978), a program that yields a maximum likelihood solution for the parameters suggested in Figure 1. The program estimates the specified parameters among the independent and dependent variables as well as between underlying and observed measures of variables and the uniqueness associated with each variable. That is, the program simultaneously evaluates the structural model and the measurement model hypothesized to account for the observed data. The program computes a reproduced correlation matrix based on the parameter estimates and a chi-square test of significance of the difference between the observed and reproduced correlation matrix. Further, of key interest in this article, is the capability to estimate reciprocal effects. Jöreskog (1978) provided the mathematical background for the procedure and Burt (1973) and Maruyama and McGarvey (1980) discussed its use and provided examples.

The use of LISREL necessitated redefinition of variables to achieve identification; that is, to have enough separate pieces of information to estimate and test each of the parameters suggested by our model. In the case of the data analyzed in this article, the redefinition involved treating items in scales as indicators of the construct measured. The full model evaluated by LISREL is presented in Figure 2. It should be noted that even with this expansion of the observed variables the measurement model in this design is not ideal. Only life satisfaction is overidentified; the job perception variables, each with three indicants, are just identified and job satisfaction is underidentified.

A requirement of both 2SLS and LISREL is that the exogenous variables are unrelated to the error terms associated with the two endogenous variables.

This is referred to as the unmeasured variables problem and it occurs when some variable that is a cause of the endogenous variable(s) is correlated with the exogenous variables in the model. For the unmeasured variable to be a significant problem, it must make a unique contribution to the prediction of the endogenous variables. That is, one need not worry about unmeasured variables that are redundant with measured variables. The consequence of this problem is a biased estimate of the structural parameters relating the endogenous and exogenous variables in the model.

Recently, James (1980) has presented three decision rules for use in determining the seriousness of the unmeasured variables problem. The first step involves a decision as to whether there are potential other causes of job or life satisfaction. The job satisfaction variable includes extrinsic and intrinsic components and the extrinsic component, in particular, may have additional causes such as pay, supervision, or promotion policy that may correlate with job perception variables. Two additional possible correlates of job satisfaction are job involvement and education (e.g., see James & Jones, 1980). Job involvement, however, is likely highly colinear with the job perception variables, which means it is unlikely that job involvement would be uniquely associated with job satisfaction. Education, as it usually indicates that one holds a more complex job, may also be highly correlated with the job perception variables. A cursory reading of the literature on job satisfaction will likely suggest other possible unmeasured variables. The seriousness of this problem for our model obviously is indeterminable and awaits collection of data on additional unmeasured variables.

The same caveat holds for life satisfaction. If in addition to marital status, self-esteem, and locus of control, there exist unmeasured variables correlated with our three exogenous variables and uniquely with life satisfaction, there will be distortion of the structural parameters between life satisfaction and its three hypothesized determinants.

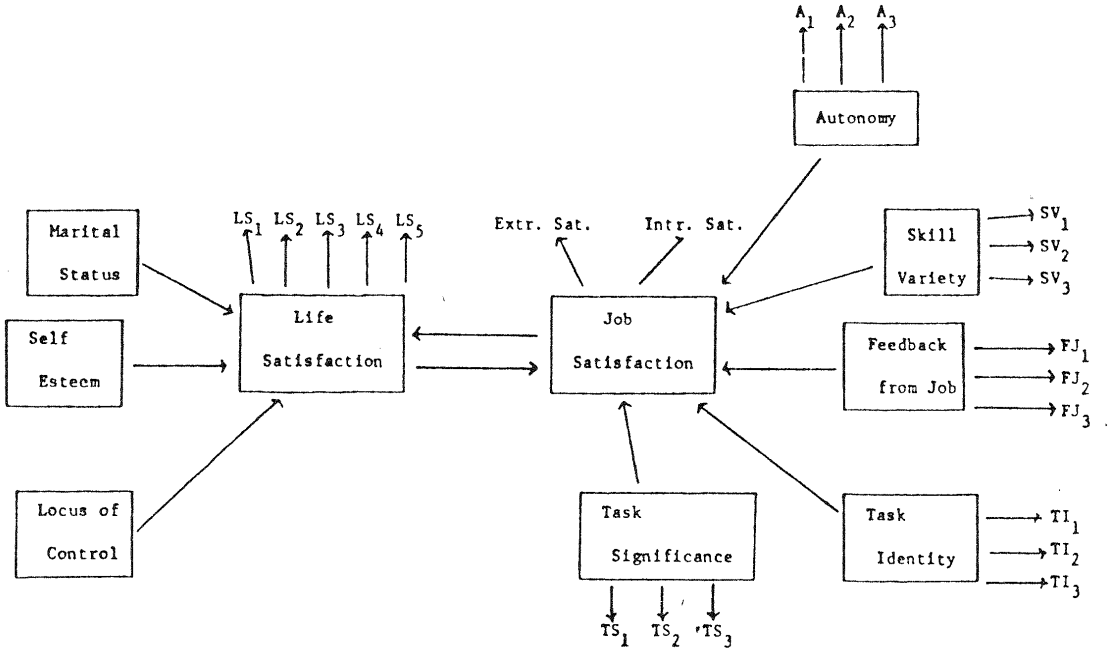

Figure 2. Structural and measurement model evaluated by LISREL. (In addition to the parameters indicated above, covariances among the endogenous variables, covariances among the exogenous variables, and the uniqueness associated with all measured variables with more than one indicator were estimated. Extr = extrinsic, Inst = intrinsic; Sat = satisfaction.)

Results

Two-Stage Least Squares Analysis

Reliabilities, intercorrelations, means, and standard deviations of the scales are presented in Table 1. As can be seen in Table 1, there is bivariate support for the Figure 1 model. Correlations of marital status, self-esteem, and locus of control are correlated higher with life satisfaction than with job satisfaction; the job perception variables are more highly correlated with job satisfaction than life satisfaction; and job and life satisfaction themselves are moderately correlated. Internal consistencies of the scales are generally good with the possible exception of feedback from the job and task significance. Further, multicollinearity is likely a problem only for the job perception variables.

As outlined above, the first stage of the 2SLS procedure consisted of a regression of both job and life satisfaction on all exogenous variables. To obtain estimates of the parameters relating job and life satisfaction it is necessary to first purge job and life satisfaction of their correlation with unmeasured causes of each other. Scores created by the first-stage least squares equations are unrelated to such unmeasured causes. The multiple corelations for job and life satisfaction were .67 and .49, respectively, indicating that significant and meaningful proportions of the variance in the dependent measures had been accounted for.

The second stage of 2SLS was conducted after replacing the values of job and life satisfaction with predicted values for those two variables based on the first-stage equations. The results of the second-stage analysis are presented in Table 2. The following summary statements are appropriate. First, the structural parameters relating job and life satisfaction are both significant; the relationship leading from job satisfaction to life satisfaction is somewhat larger though not significantly so (James, 1981). Second, the parameters for all three hypothesized determinants of life satisfaction were significant. Self-esteem seems most directly related to life satisfaction; the parameter for locus of control is comparatively much smaller.

Table 1
Means, Standard Deviations, Reliabilities, and Intercorrelations of Variables Used in 2SLS Analysis

Variable	*M*	*SD*	Intercorrelations									
			1	2	3	4	5	6	7	8	9	10
1. Marital status[a]	1.42	.49	—									
2. Self-esteem	39.41	5.31	.10	(.83)								
3. Locus of control	38.39	5.12	.04	.32	(.69)							
4. Life satisfaction	20.84	3.22	.18	.46	.23	(.82)						
5. Job satisfaction	70.28	12.61	.06	.14	.21	.27	(.90)					
6. Autonomy	13.44	4.60	.07	.09	.10	.09	.58	(.72)				
7. Skill variety	11.31	5.29	.14	.12	.04	.13	.48	.50	(.77)			
8. Feedback from job	14.21	3.93	.06	.13	.10	.14	.45	.41	.38	(.62)		
9. Task identity	13.91	4.62	.04	.07	.06	.06	.35	.41	.23	.36	(.70)	
10. Task significance	15.44	4.32	.15	.13	.14	.10	.40	.39	.52	.35	.25	(.63)

Note. Internal consistencies are shown in parentheses on the main diagonal.
[a] Marital status was coded 1 for single and 2 for married.

Third, all of the Job Diagnostic Survey (JDS) variables contributed significantly and uniquely to job satisfaction feelings.

In general, the results of the 2SLS supported the structural model presented in Figure 1. However, consistent with the recommendations of several authors (Duncan, 1975; James & Singh, 1978; Namboodiri, Carter, & Blalock, 1975), additional tests of the logical consistency of the model were conducted. Implicit in the model depicted in Figure 1 is the assumption that marital status, self-esteem, and locus of control do not directly affect job satisfaction; likewise, it is assumed that the JDS variables do not impact in a direct manner on life satisfaction. The logical consistency of these assumptions was tested by regressing the second-stage residual for life satisfaction ($\hat{\mu}_1$ in Equation 7) on the JDS variables using ordinary least squares. Second-stage residuals for the regression of job satisfaction ($\hat{\mu}_2$ in Equation 8) on marital status, self-esteem, and locus of control were also computed. If the resulting regression weights are not significantly different from zero, then it can be inferred that

Table 2
Estimates of Structural Parameters Based on Second Stage of 2SLS

Variable	Job satisfaction	Life satisfaction
First-stage estimates of endogenous variables		
Job satisfaction		.182*
Life satisfaction	.132*	
Exogenous variables		
Marital status		.136*
Self-esteem		.407*
Locus of control		.065*
Autonomy	.367*	
Skill variety	.159*	
Feedback from the job	.140*	
Task identity	.085*	
Task significance	.087*	

* $p < .01$.

Table 3
Logical Consistency Tests for Job and Life Satisfaction

Variable	Zero-order correlation	Value[a]
Life satisfaction[b]		
Autonomy	−.01	−.016
Task significance	−.03	−.036
Task identity	−.01	−.008
Feedback from the job	.01	.025
Skill variety	.00	.022
Job satisfaction[c]		
Marital status	−.06	−.047
Locus of control	.13	.110*
Self-esteem	−.01	−.034

* $p < .01$.
[a] Estimated value of structural parameter against residual of second-stage equation.
[b] Variables not expected to have direct relationships with life satisfaction.
[c] Variables not expected to have direct relationships with job satisfaction.

Table 4
Intercorrelations of Measured Variables in LISREL *Analysis*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1. LS—1	—																								
2. LS—2	56	—																							
3. LS—3	58	75	—																						
4. LS—4	37	44	46	—																					
5. LS—5	36	38	45	39	—																				
6. JS—extrinsic	24	29	23	17	08	—																			
7. JS—intrinsic	21	21	22	12	07	64	—																		
8. Marital status	09	16	15	27	02	13	−04	—																	
9. Self-esteem	39	38	42	29	27	16	09	10	—																
10. Locus of control	18	20	23	14	13	21	18	04	32	—															
11. SV—1	05	09	06	01	01	50	38	03	05	08	—														
12. SV—2	15	07	10	01	01	45	33	08	06	13	35	—													
13. SV—3	07	09	09	01	03	52	33	06	08	06	50	56	—												
14. Auto—1	11	14	16	11	04	35	30	02	09	09	24	26	23	—											
15. Auto—2	06	07	09	06	00	26	23	07	11	09	31	12	20	28	—										
16. Auto—3	06	09	13	09	01	39	31	06	11	05	29	26	35	37	41	—									
17. FJ—1	04	02	01	−03	03	24	17	−01	01	03	25	20	23	15	19	22	—								
18. FJ—2	05	08	05	01	00	26	24	05	07	07	21	29	20	21	16	26	52	—							
19. FJ—3	05	09	08	03	01	33	26	05	09	06	32	26	41	18	21	36	34	39	—						
20. TI—1	06	04	05	12	01	19	07	09	09	11	13	10	09	16	10	14	00	07	06	—					
21. TI—2	06	11	07	14	00	40	28	09	09	13	36	15	24	18	35	26	15	13	23	27	—				
22. TI—3	08	09	04	10	−04	40	20	15	11	08	34	28	36	18	14	29	10	11	28	36	42	—			
23. TS—1	13	14	11	09	−03	41	24	17	11	02	32	29	32	22	19	28	07	13	28	21	35	44	—		
24. TS—2	08	10	09	09	01	44	24	13	12	04	39	17	35	16	26	26	13	03	22	17	35	38	54	—	
25. TS—3	11	13	12	07	05	51	29	05	09	06	41	29	47	23	21	32	12	09	32	17	34	43	48	57	—

Note. LS = life satisfaction; JS = job satisfaction; SV = skill variety; Auto = autonomy; FJ = feedback from the job; TI = task identity; TS = task significance. Decimal points have been omitted.

the corresponding exogenous variables were not directly related to job or life satisfaction, which is what the model implied. If, on the other hand, any of the regression weights predicting $\hat{\mu}_1$ or $\hat{\mu}_2$ are significant, then it would be inferred that there is a direct relationship that is not consistent with the model. The two regressions yielded one inconsistency. Locus of control was significantly related to the residuals of the job satisfaction variables, whereas none of the job perception variables were related to errors of prediction in the life satisfaction variable, indicating the possibility of an additional direct relationship between job satisfaction and locus of control. The results of these logical consistency analyses are reported in Table 3. In the single instance in which the logical consistency test failed, the effect is not large ($r = .13$).

LISREL Analysis

Since the LISREL program evaluates the appropriateness of the measurement model and the structural model simultaneously, more measured variables are required to achieve identification. In the analysis described in this section, this identification problem was solved by breaking several of the variables used in the 2SLS analysis into their constituent parts. Job satisfaction was divided into its extrinsic and intrinsic job satisfaction subscales; life satisfaction was indicated by its five items; autonomy, skill variety, feedback from the job, task identity, and task significance are indicated by the three items in their respective scales. The correlation matrix that was input to the LISREL program is presented in Table 4. As can be seen in Table 4, the indicants of a given underlying construct do correlate more highly with each other than with other variables in the matrix. This, of course, is also evident in comparisons of the internal consistencies and intervariable correlations presented in Table 1.

The results of the LISREL analysis are depicted in Figure 3. The squared multiple correlations for job and life satisfaction, respectively, were .82 and .30. The covariance among the residuals of these two endogenous variables was −.019, which was nonsignificant statistically. The figure indicates statistical significance for the structural parameters, only two of which were nonsignificant. The residual matrix, that is, the difference between the correlation matrix and the correlation matrix reproduced by application of the values for the structural parameters indicated in the model, was comprised of relatively low values (most were less than .05) indicating that the model fit the data reasonably well. The chi-square test of the difference of the reproduced and observed matrices yielded a significant result, $\chi^2(239) = 825.39$. Whereas this is generally viewed as disconfirmatory evidence, Jöreskog (1978) and others (Burt, 1973; Tucker & Lewis, 1973) have warned that this test is very powerful with large sample sizes and will usually result in the rejection of a model. Alternatively, a χ^2/df ratio of 5:1 or 10:1 is suggested as a reasonable cutoff. By the later criterion our results that represent a ratio of about 3.5:1 represent a reasonable fit. Since χ^2 and χ^2/df indexes are dependent on total sample size and the assumption of multivariate normality is likely violated in this set of data, several alternative methods of assessing the appropriateness of a model should be explored. Examination of the residual matrix, as reported above, indicated few large values. Further, these large values did not involve relationships among variables that would suggest any alteration of the model. Most of these large values occurred among the JDS variables, suggesting perhaps that some other structure than the one specified for these five variables might be more appropriate. This is not surprising in light of research evidence on the factorial structure of the JDS (e.g., see Dunham, 1976). Recently, Bentler and Bonett (1980) have provided degree of fit statistics for covariance structure models that involve a comparison of hypothesized models with alternative models—one of which may be a saturated model consisting of as many parameters as there are variances and covariances, and a second null model specifying a lack of relationship among variables. Comparison of the residual matrix of a hypothesized model such as the one presented in this paper with the two extreme models (i.e., the saturated and null models) allows computation of degree of fit statistics.

A sumary of the comparison of the LISREL results with those of the 2SLS presented earlier is as follows: First, the estimates of the

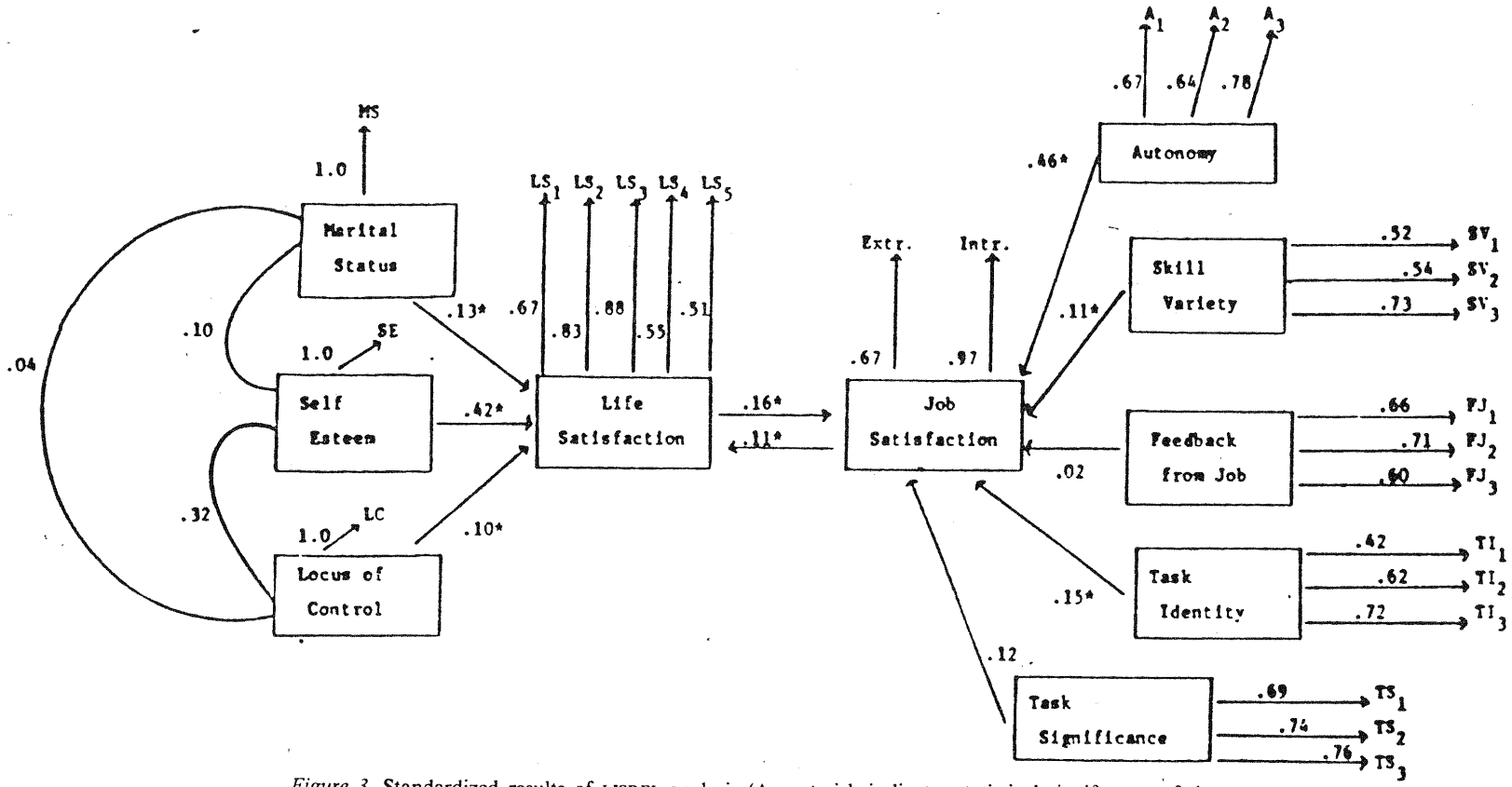

Figure 3. Standardized results of LISREL analysis (An asterisk indicates statistical significance of the structural parameter. Because a single indicator existed for marital status, self-esteem, and locus of control, the observed–underlying construct relationship was set equal to 1.00. Correlations among the exogenous variables are available from the senior author.)

parameters of the exogenous variables leading to both job and life satisfaction are roughly equivalent. Second, the mathematics associated with the LISREL program are far more complex and less familiar to most behavioral researchers than are those of 2SLS. Further the simultaneous solution of the measurement model and the structural model that is characteristic of LISREL analyses may yield severely distorted estimates of the structural parameters (Gerbing, 1979). Gerbing argued from a conceptual standpoint for the separate solution of measurement and structural models. The identification problem for LISREL is also significant in that no easily used procedures exist for the determination of whether a part or the whole of some model is identifiable. The practical problem of obtaining enough indicants of all latent variables is also significant. Third, the answer to the substantive question we posed seems to be that there is a significant reciprocal relationship between job and life satisfaction. Finally, an earlier cautionary remark concerning the lack of ability to make causal inferences should be repeated; our model seems reasonably consistent with the data, but other models exist that would do as well.

Discussion

From a substantive point of view, our results support a revised spillover model of the life–job satisfaction relationship in which there are job–life and life–job satisfaction relationships. The zero-order correlations as well as both structural equations analyses were consistent with the reciprocity hypothesis. The strength of the self-esteem–life satisfaction relationships suggests that self-esteem might be usefully treated as an explanatory variable in work-related contexts. A source of bias in our model may arise from the possibility that the job satisfaction–job perception relationship may be reciprocal. James and Jones (1980) found a reciprocal relationship between these two constructs and the job satisfaction–job perception parameter was large both in relative and absolute terms.

The logical inconsistency that was revealed by tests of the 2SLS model is consistent with past research that indicates that locus of control is associated with job satisfaction (Andrisani & Nestel, 1976).

From a methodological point of view, the two procedures produced very similar results for this set of data. Some experience with LISREL and regression analysis leads us to believe the multicollinearity produces greater distortion in LISREL solutions than it does when one uses regression analyses. Gerbing's (1979) solution is to solve measurement problems first and then use ordinary least squares. Certainly, the implication of a poor measurement model for the estimation of structural parameters using LISREL needs to be examined more thoroughly.

The use of LISREL also requires multiple indicators of constructs that, given practical constraints on data collection, may not always be feasible. On the positive side, this forces careful consideration of one's hypotheses prior to data collection. Finally, the use of LISREL has been facilitated greatly by newer versions of the program (Jöreskog & Sörbom, 1978) and quantitative researchers are providing solutions to some early difficulties with application of the procedure (e.g., Bentler & Bonett, 1980).

Both techniques require very large sample sizes for interpretable parameter estimates, especially when multicollinearity is a problem. It is also true that neither technique provides proof of a causal model; hypotheses concerning causation can be rejected, but there are usually multiple models in addition to the one tested that are consistent with the data. If predictions regarding fixed and free parameters are borne out by empirical analysis, the model is corroborated and a basis for causal inference exists. Although the possibility of additional models that fit the data equally well exists, the results reported in this article suggest that an inference of reciprocal causation between job and life satisfaction provides a useful explanation for their covariation.

LISREL is perhaps most informative when one is comparing competing models (Bentler & Bonett, 1980; Jöreskog & Sörbom, 1978). One restricts a parameter to zero or to be equal to some other parameter and tests to see if there is a significant increase in chi-square or a "practically" significant change in degree of fit statistics. For example, we

could have restricted one of the two paths between job and life satisfaction to zero or indicated that both should be equal. However, it is important to remember that such "playing around" with parameters constitutes an exploratory rather than a confirmatory analysis if no a priori reasons exist for the additional tests.

In conclusion, many of the relationships behavioral scientists study likely involve reciprocal causality. More attention should be directed toward the development and dissemination of analytic techniques that allow their estimation. Both of the techniques discussed in the current paper have been available for some time and should be more frequently employed.

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