

## AN APPLICATION ABOUT THE PROBLEMS OF WOMEN IN THE LABOUR FORCE WITH MULTIPLE CORRESPONDENCE ANALYSIS

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### ABSTRACT

In this article, the problems of women's labour in the working in the businesses, their expectations from the job she performs, and their manner of expending of the income they earn are discussed by taking into the consideration various variables with Multiple Correspondence Analysis.

**Key Word:** Multiple Correspondence Analysis, Loss Function, Categorical Data, Women In The Labour Force

### 1. INTRODUCTION

The labour force participation of women has great importance both for female workers and for the society. As a matter of fact this situation affects and changes women's role that is limited in the economy the economic dependency on man is a serious problem has been going on for centuries. In other words, today an increasing number of women become economically independent by participating into the labour force. The role of women in the family and the society are being different.

While an increasing number of women participates into the labour force today, the situation of women in the labour force and the problems of female workers have been discussed from the point of positive and negative sides by unions, universities and governments. On one side the benefits of earning an income are discussed and on the other side the problems of female workers are tried to focus.

The working in the businesses provides a lot of advantages to a woman. One of them is economical independency and the other is increasing of social value. But on the other hand there are problems since traditional values and

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attitudes continue. As a matter of fact woman is between working and family life today. Trying to meet the daily needs makes a woman fall in a dilemma that is seen to cause her overload.

A woman uses her income that she has earned from her work, to support her partner who undertakes the living of family and the education of children as his essential duty. So woman has become productive as contributing in finance to her husband in addition to the role as a housewife and the mother of children in the family.

The main aim of this paper is to reveal the problems of women in the labour force. With this purpose, starting from the data sustained by the field research; the problems female workers face in the businesses, expectations from the job they perform and their manner of spending of the income they earn are discussed by taking into consideration various variables with Multiple Correspondence Analysis. As analysing the above-mentioned matters SPSS package programme has been used.

## **2. MULTIPLE CORRESPONDENCE ANALYSIS**

Multiple correspondence analysis or with its other name homogeneity analysis is used for analysing multi-way contingency tables that have three or more categorical variables (Carroll & Green, 1988). Analysis gives information about what kind of a combination will the categories of variables be in a two dimensional graphic. In other words, the analysis is one of graphical analysis that is used for collaboration and connection of concentric table which is crosswise differently such as  $R \times C \times M \dots$  (Özdamar, 1999).

In multiple correspondence analysis, difference between variables has been expressed by a loss function. The purpose is to minimize loss function and to maximize homogeneity between variables. Alternating Least Squares (ALS) minimizes the loss function and the object scores that provide maximum homogeneity and category quantification are reach.

The measurement level of all variables those are used in the analysis is multiple nominal. In that case, the analysis gives multiple quantifications and multiple solutions. In other words, the analysis is different for each dimension. The optimal category points will be in the centre of gravity of the object points that share the same category (Heiser&Meulman, 1994).

If  $n$  was symbolized the number of object and  $m$  was symbolized the number of variables, we get multivariable data matrix by the dimension of

$n \times m$ . If we accept  $j$  as  $j = 1, \dots, m$  in that case  $k_j$  shows category number of  $j$  variable and  $K = \sum_j k_j$  denote the total number of categories over all variables.

To see the place of original data matrix we mentioned above, on a graphic we use low dimensional Euclidian space  $R^p$ . In that case, object and categories should be scaled. Let  $X$  be the  $n \times p$  matrix contains the coordinates of the object vertices in  $R^p$ , and  $Y_j$ , the  $k_j \times p$  matrix contains the coordinates of the  $k_j$  category vertices of variable  $j$ .  $X$  is named the object scores matrix and  $Y_j$  is the category quantifications matrix. Besides, that  $j$  variables indicator matrix which has  $n \times k_j$  dimension defined as  $G_j$ .  $i = 1, \dots, n$  and  $t = 1, \dots, k_j$  if object  $i$  belongs to category  $t$ , and  $G_j(i, t) = 0$  if it belongs to some other category.

The loss function that uses  $X$ ,  $Y_j$  and  $G_j$  matrix over all variables defined by squared deviance is showed below.

$$\sigma(X; Y_1, \dots, Y_J) = m^{-1} \sum_j SSQ(X - G_j Y_j) \quad 1$$

Where  $SSQ(H)$  denotes the sum of squares of the elements of the matrix  $H$ . In this loss function, which is heart of Gifi system minimize simultaneously over  $X$  and  $Y_j$ 's. In this function in order to avoid  $X = 0$  and  $Y_j = 0$ , it is required  $X'X = nI_p$  and  $u'X = 0$  normalization restriction. Where  $I$  is the  $p \times p$  identity matrix and  $u$  is a vector of appropriate dimensions comprised of all ones (Michailidis&Leeuw,1996).

Considering normalization restriction, which mentioned below, using Alternating Least Squares (ALS) algorithm minimizes function number 1. In the first step of the algorithm is minimized with respect to  $Y_j$  for fixed  $X$ . In the second step of the algorithm is minimized with respect to  $X$  for fixed  $Y_j$ 's.

In the final step of the algorithm the  $X$  matrix is column centred by setting  $W = \hat{X} - u(u'\hat{X}/N)$ , and then orthonormalized by the modified Gram-Schmidt procedure  $X = \sqrt{N}GRAM(W)$ , so that the normalization restrictions are satisfied. The ALS algorithm cycles through these three steps until it converges.

To evaluate fit of the derived map in multiple correspondence analysis are used discrimination measures and eigenvalues.

Geometrically the discrimination measures give the average squared distance (weighted by the marginal frequencies) of category quantifications to the origin of the  $p$  dimensional space. It can be shown that (assuming there are no missing data) the discrimination measures are equal to the squared correlation between an optimally quantified variable  $G_j Y_j(.,s)$  and the corresponding column of object scores  $X(.,s)$  (Gifi,1990& Greenacre,1993). Besides, eigenvalues are corresponded to the average of the discrimination measures and give an overall measure of fit of the derived map in each of the  $p$  dimensions (www.spss.com...).

The number of derived dimension in multiple correspondence analysis; the number of categories of variables - the number of variables. In addition to derived dimension number = the fit of the derived map (eigenvalues) + loss value.

### 3. APPLICATION

This search is based on the data sustained by the field research. Turkey Confederation of Employer Unions (TISK) supported the field research. A 30-questioned questionnaire has been prepared and the forms have been applied to female workers with the mediation of personal resources managers in Bursa manufacturing industry. The search's sample is originated with 500 women workers. In the questionnaire, there are not only general questions to determine the demographic characters but also questions directed to the problems that women in the labour force face in businesses and family independent economic behaviour. For this reason, in order to test the female workers together with demographic data Multiple Correspondence Analysis is discussed handling three variables.

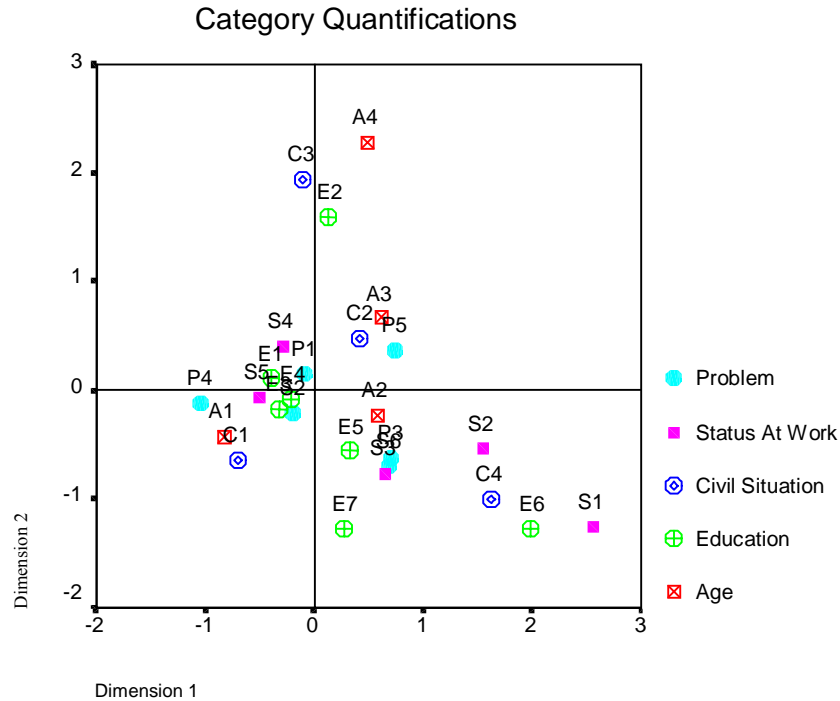
In this frame first of all, the most important problem variable that women in the labour force face is analysed together with her status at work,

with her civil situation and with her education and age and these results are attained as below:

**Table 1.** The Discrimination Measure of Each Variable and Each Dimension

<b>Variables</b>	<b>Dimension 1</b>	<b>Dimension 2</b>
Age (A)	.474	.533
Education (E)	.453	.551
Civil situation (C)	.369	.367
Status at work (S)	.495	.214
Problem (P)	.097	.073
<b>Eigenvalues</b>	<b>.3777</b>	<b>.3476</b>

It can be said that the conformity between the real graphic and two-dimensional graphic obtained is rather good, when we examine the eigenvalues that gives us the exact calculation of the conformity between the real graphic and the graphic detained from each dimension in the table. As it is indicated before, discrimination measures are squared correlations. In this situation, it is seen that status at work and problem variables assist to explain the first dimension, age and education variables assist to explain the second dimension and civil situation variable assists to explain the both dimensions. In other words, the categories of status at work and problem variables condense in the first dimension, the categories of age and education variables condense in the second dimension and the categories of civil situation condense in the both dimensions. The graphic obtained as a result of the analysis is as below:



When the graphic above is examined, the married (C2) women labour force between the ages 35-43 (A3) has declared that in case of a special permission (such as illness, birth, breastfeeding, pregnancy, child care, etc) because of being married, they face (P5) negative attitudes of the managers. As a matter of fact this result is the biggest problem of all workingwomen if they are married and have children.

Women between the ages 26-34 (A2), who are college graduates (E5), office workers (S3), have declared that the most important problem they have because of being women is their men colleges negative attitudes and manners. When examined from the angle of civil situation it is seen that singles (C1) are closer to this group.

Women between the ages 17-25 (A1), who are primary school (E1) graduates, high school (E3) graduates, qualified (S4), unqualified (S5) women are also seen to have difficulties and problems related to working.

Secondly, women's expectation from working in the businesses variable are analysed together with status at work, pay, the age group of the

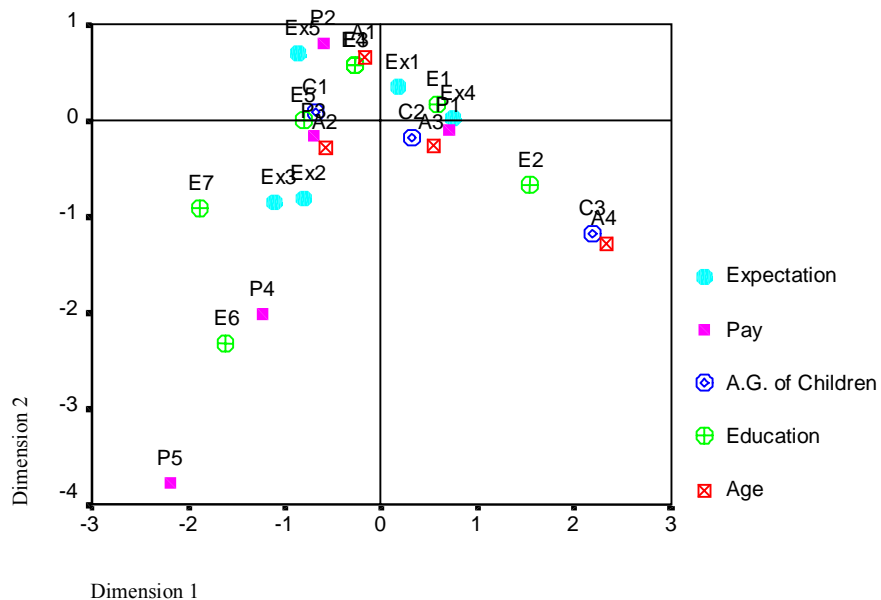
children, education and age and the discrimination measure of each variable and each dimension is given below:

**Table 2.** The Discrimination Measure of Each Variable and Each Dimension

Variables	Dimension 1	Dimension 2
Age (A)	.562	.337
Education (E)	.722	.772
Age group of the children (C)	.492	.120
Pay (P)	.514	.631
Expectation (Ex)	.303	.241
<b>Eigenvalues</b>	<b>.5184</b>	<b>.4200</b>

When Table 2 is examined it is seen that the conformity between the real graphic and the derived graphic is rather good. Besides, again when the table is examined it is seen that age, age group of the children and expectation variables assist to explain the first dimension and pay, education variables assist to explain the second dimension. The category quantification obtained as a result of the analysis is as below:

### Category Quantification



On the left bottom side of the graphic it is seen that women, who have completed university (E6) and post graduate educations and have a PhD (E7), have a high salary (P4); primarily expect their pays to be raised (Ex2) and to reach higher levels (Ex3). In other words the woman in this group has a career expectation. And naturally career will bring together the raise of income.

When the gathering on the right upper side of the graphic is examined, it is seen that women who have children between the ages 7-17 (C2), who are between the ages (A3) 35-43, primary school graduates (E1) and who try to live on minimum wage (P1); expect just to earn the cost of living (Ex1) and to finish their service period and be retired (Ex4). This result is very meaningful. As a matter of fact, women of lower education just work in order to contribute to family in come and have social guarantee which is brought to light with the searches about this subject.

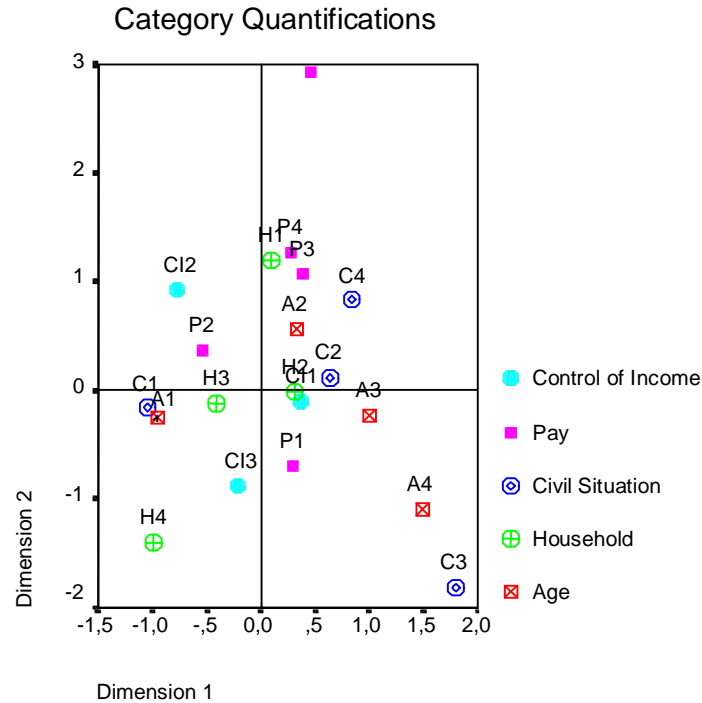
Thirdly, by whom the individual income of women labour force is controlled variable is analysed together with civil situation number of the members in the house and age and the results below are achieved.

**Table 3.** The Discrimination Measure of Each Variable and Each Dimension

<b>Variables</b>	<b>Dimension 1</b>	<b>Dimension 2</b>
Age (A)	.722	.236
Household (H)	.166	.329
Civil situation (C)	.723	.084
Pay (P)	.141	.585
Control of income (CI)	.219	.334
<b>Eigenvalues</b>	<b>.3941</b>	<b>.3138</b>

When the eigenvalues are examined in Table 3 it is seen that the conformity between the real graphic and the derived graphic is good; besides, age, civil situation variables contribute to explain the first dimension and number of the members in the house, pay and control of income variables contribute to explain the second dimension. The graphic obtained as a result of the search is below:





When the graphic is examined, the gathering at the bottom shows that women labour force, which have minimum wage (P1) and with 7 or more members in the house (H4), leave all the control of income (CI3) to the bass of the family.

Examining the gathering on the left side of the graphic, it is seen that women labour force, between the ages (A1) 17-25, single (C1), with 5-6 members in the house (H3), with middle wage (P2); invest some amount of the income they earn for their labour force without including to the cost of living (C12).

When the gathering on the right upper side is examined, it is seen that women labour force, between the ages (A2-A3) 26-43, married (C2), with 3-4 members in the house (H2); use (CI1) all the income for the family's cost of living. The remarkable point here is using the income in a democratic family structure in association and each working partner acquires the control of income.

#### 4. CONCLUSION

The problems of the women in the labour force face working in the businesses are very different. In this article the problems of the female workers in Bursa manufacturing industry face both in working and family life, together with expectations are analysed with Multiple Correspondence Analysis whether they are related to age, civil situation, education, number of the members of the household variables.

The results below are obtained considering the data found:

- Female workers the leave control of the income to her partner as her wage she earns decreases.
- Married woman mostly complain about the managers negative attitudes.
- The lower income group of female workers expect only the cost of living by working.
- When the female workers have higher incomes by higher educational qualifications they are focused on raising their wages more and having new works of upper class duties.

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