مجلة جامعة تشرين للبحوث والدراسات العلمية _ سلسلة العلوم الاقتصادية والقانونية المجلد (35) العدد (8) 2013
Tishreen University Journal for Research and Scientific Studies -Economic and Legal Sciences Series Vol. (35) No. (8) 2013

# Applying Factor Analysis for Studying the Most Important Factors Economic Affecting the number of employees within period 2000 till 2009 in Syria

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**(Received 24 / 3 / 2013. Accepted 10 / 12 / 2013)**

## □ ABSTRACT □

The objective of this research is applying Factor Analysis for Studying the most important economic factors affecting the number of employees within period 2000 till 2009 in Syria, to propose a methodological framework for constructing the integrated factor analysis model system (FAMS) that can be used as a decision support tool in employment year examination and supervision process for detection of years, which are experiencing serious problems. Sample and variable set of the study contains 17 economic variables.

Study years (10 years during the period 2000–2009) and their economic variables. Well known multivariate statistical technique (principal component analysis), was used to explore the basic economic characteristics of the theses years, and discriminant models were estimated based on these characteristics to construct FAMS. The importance of factor analysis model system in employment year examination was evaluated with respect to defining the non-employment years for deciding the most important employment policy for reducing unemployment rates in future.

Results of the study show that, if FAMS was effectively employed within studied years, It is possible in this case to identify weaknesses, according to the years that have the number of employees is less than the overall average calculated over the period.

**Keywords:** Factor Analysis, Principal Component, Multivariate analysis, Employment

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# تطبيق التحليل العاملي في دراسة أهم العوامل الاقتصاديّة المؤثّرة في تغيّر عدد المشتغلين خلال الفترة 2000-2009 في سورية

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**(تاريخ الإيداع 24 / 3 / 2013. قُبِل للنشر في 10 / 12 / 2013)**

## □ ملخّص □

إنّ الهدف الرّئيسي لهذا البحث هو تطبيق التحليل العاملي في دراسة أهم العوامل الاقتصاديّة التي تؤثّر في عدد المشتغلين خلال الفترة 2000-2009 في سورية. بغية اقتراح إطار ممنهج لتركيبة متكاملة تشكّل نظام نموذج التحليل العاملي, الذي يمكن استخدامه بوصفه أداة دعم القرار في عمليّة تحليل سنوات التشغيل في سورية ومساعدة متخذ القرار في تحديد السّنوات التي تعاني من مشاكل حقيقيّة. إنّ عيّنة الدّراسة تحتوي على 17 متغيّر اقتصادي موزّعة خلال سنوات الدّراسة التي هي 10 سنوات خلال الفترة 2000-2009, تمّ استخدام تقنيّة التحليل المتعدّد المتغيّرات الذي يرتكز على (تحليل المركب الأساسي), بهدف استكشاف الخصائص الأساسيّة للسنوات من خلال المتغيّرات الاقتصاديّة المدروسة. وتمّ تقدير نماذج (التحليل التمايزي) بالاعتماد على تلك الخصائص المميّزة لتركيب النموذج FAMS.

إنّ أهميّة نظام نموذج التحليل العاملي تأتي من خلال استخدامه في عمليّة تقسيم سنوات الدّراسة إلى مجموعتين, المجموعة الأولى وهي مجموعة سنوات التشغيل, والمجموعة الثّانيّة هي مجموعة سنوات انخفاض التشغيل, الأمر الذي يساعد في تحديد سياسة التشغيل الأفضل والتي تساعد في الحدّ من البطالة.

كان من أهمّ نتائج الدراسة أنّه في حال أمكن تطبيق النموذج المقترح FAMS , خلال السنوات المعتمدة للدراسة, فإنّه من الممكن في هذه الحالة تحديد نقاط الضعف بحسب السنوات التي كان فيها عدد مشتغلين أقل من المتوسط العام المحسوب خلال الفترة.

**الكلمات المفتاحيّة:** التحليل العاملي, المركّب الأساسي, التحليل متعدّد المتغيّرات, التوظيف

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## Introduction

Factor analysis is used to**:**

1. reduce the dimensionality of large number of variables to a fewer number of factors.
2. to confirm a hypothesized factor structure by way of testing of hypotheses about the structuring of variables in terms of the expected number of significant factors and factor loadings.**[1]**

Multivariate analyses of economic variables time series data can described by economic variables, that are highly dynamic systems, and understanding these dynamics and its affecting in number of employers is of crucial importance, identifying dynamic networks of variables interaction is important for designing the liner model , and for the use of the model. Traditional analytical approaches are not suitable to detect these interactions.**[2]**

## The Research Problem:

The Research Problem is described by:

There are many years show a number of employees is less than mean of, within study period, that effect on un-employment rate and increase this rate, so we try to design an effective model to predict of non-employment years, and help decision makers in employment planning.

## The research importance and purpose's:

The importance of this research comes from the importance of factor analysis and its benefits which provided by; It works on assembly the related variables, to form a group of components so that each group includes a set of variables that are to be associated strongly with each other, in order to reach to a smaller number of variables in the form of components that can be considered independent variables and affect the dependent variables.

This research helps decision makers in defining tools to reduce un-employment rate, by using factor analysis model system (FAMS), that designed for applying factor analysis for studying the most important economic factors affecting the number of employees within period 2000 till 2009 in Syria.

## Application of the Research:

The descriptive Methodology has been adopted, and it used statistical package for social sciences(Spss), for finding factor analysis model system (FAMS).

## Statistical Techniques Applying:

The researcher has used the following statistical techniques, standard deviations, exploratory factor analysis (EFS) via principal components, Varimax rotation.

## Population and Sample of the Study

The Population of the study consists of some macro-economic variables of Syrian economy. Intentional sample, of 17 variables for ten years from 2000 till 2009, has been selected.

## The Research Hypothesis:

It is a significant model that describes the relationships among economic factors as a liner compound, and the linear combination of the factors scores provide for each year a D-score, according to the estimated canonical discriminant model below:

$$D_y = \sum B_i F_i$$

Where $B_i$ is: Score coefficient for component (i).

And $F_i$ is: Component (i) .

## Articles Published in the Field of Research:

**1- Factors Affecting Manpower Capacity Development among Agribusiness-Based Entrepreneurial Organizations in Abia State, Nigeria**, for Onwumere, J., and U. Okoro**[3]**:

The study examined the factors affecting manpower development among agribusiness-based entrepreneurial organizations in Abia state, Nigeria. Data were collected from 75 agribusiness-based entrepreneurial organizations from two local government areas within the two agribusiness zones of Abia State. The method of data collection was through a random sampling technique and the instruments of data collection were questionnaire and oral interviews.The data collected were analyzed were with descriptive statistics, chi-square and Ordinary Least Square multiple regression analysis. Results revealed that, majority of the firms (56.2%) are well informed and experienced in agribusinesses management practices used by the firms; the agribusiness-based entrepreneurial organizations that produce primary agribusiness raw inputs have more manpower (80.36percent) than organizations that used the raw materials for further production. Working condition was observed to influence (100 %) the operations of both entrepreneurial organizations producing primary agribusiness raw inputs and that of those using the raw materials respectively. A total of the firms (68.75percent) using primary agribusiness raw materials are facing constraints of low market patronage. A further analysis showed that there is a significant difference between manpower development and productivity. Results of the multiple regression analysis showed that income, capital available for training and productivity were the major factors that positively and significantly affected manpower development.

The study recommends among others, that government and policy makers should come up with tax protection policies for agribusiness-based entrepreneurial organizations as it is found to be hampering the firms development especially manpower wise.

**2- The "Employment Intensity" of Growth in Europe**, for Jörg Döpke**[4]**:

The paper elaborates on the employment intensity of growth. Previous evidence regarding this question is surveyed. Empirical results concerning Europe and selected other industrial countries reveal that the cyclical link between unemployment and growth is still stable in the nineties. However, the relation strongly depends on the variable chosen to represent the labor market situation. Test on an asymmetric relation leads to ambitious results. Cross-country and panel evidence suggest that the employment intensity of growth is influenced by the country’s wage setting process, the share of the service sector, and labor market flexibility. A clear-cut importance of exchange rate volatility cannot be found. Some conclusions with regard to economic policy are drawn, and the most important conclusions increasing the employment intensity of growth is — of course — not a political aim. Reducing labor productivity would reduce the real per capita income and, thus, economic welfare.

## That's new in our research is:

**-** Applications of common factor analysis for man optimal power planning in Syria.

- This research explain how many factors as macro-economic interdictors can affect success or fail of man power planning depending on Da function.

- This research aim to explain dynamic relation between methods of multivariate analyzes as (factor analysis, canonical analysis, ANOVA,….) and liner regression after extract factors.

## Multivariate analysis:

As the name indicates, multivariate analysis comprises a set of techniques

dedicated to the analysis of data sets with more than one variable. Several of these techniques were developed recently in part because they require the computational capabilities of modern computers. Also, because most of them are recent, these techniques are not always unified in their presentation, and the choice of the proper technique for a given problem is often difficult**[5]**.

Generally, the subject of Multivariate analysis deals with the statistical analysis of the data collected on more than one (response) variable, these variables may be correlated with each other, and their statistical dependence is often taken into account when analyzing such data, in fact, this consideration of statistical dependence makes multivariate analysis somewhat different in approach and considerably more complex than the corresponding univariate analysis, when there is only one response variable under consideration**[6],** That means multivariate designs can be distinguished from the univariate and bivariate designs with which readers are likely already familiar, experimental designs that are analyzed with t tests or analysis of variance (ANOVA) are univariate designs, so named because there is only a single dependent variable in the design and analysis of the data**[7]**.

So we can defining the Importance of Multivariate Designs as**[8]**:

1. Many experimental studies are likely to affect the study participants in more than one way.

2. Using multiple criterion measures can paint a more complete and detailed description of the phenomenon under investigation.

There is a wide range of multivariate statistical tools available with potential application for economy analyses, Our work is mainly based on the use of principal component analysis (PCA) for data compression and partial least square regression (PLSR) for multivariate regression analyses**[9]**[*]**.**

## Concepts of factor analysis(FA):

Basically there are two types of factor analysis, namely, exploratory factor analysis and confirmatory factor analysis. Both types of factor analyses are based on

"Common Factor Model"**[10].**

The primary objectives of an exploratory factor analysis are to determine the number of common factors influencing a set of variables and to determine the strength of relationship between each factor and each observed variable, In other words, it is used to explore the underlying structure of a set of observed variables when there are no a priori hypotheses about the factor structure**[11].**

[*] **We have used PCA as a method of factor analysis based on correlation matrix and based on eigenvalue greater than (1). And we have used PLSR to estimate regression model among components (independents variables), and the dependent variable.**

The confirmatory factor analysis is used to test or confirm specific hypotheses about the factor structure for a set of variables, exploratory factor analysis is simpler to perform than confirmatory factor analysis, a larger sample size is required for a confirmatory factor analysis than for an exploratory factor analysis, for these reasons the commonly used type is exploratory factor analysis**[12].**

**FA** involves a mathematical procedure that transforms a number of (possibly) correlated variables (in our case: economic variables data) into a (smaller) number of uncorrelated variables called principal components, The first principal component accounts for as much of the variability in the data as possible, and each succeeding component accounts for as much of the remaining variability as possible. The result is a new set of variables that represent linear combinations of the original variables that are uncorrelated and reflect the most important structure of the data. Values for each sample projected onto these "loadings" are then calculated and called "scores"**[13].**

## Factor Analysis Model:

The following assumes that the $p$ observed variables (the $Xi$) that have been measured for each of the $n$ subjects have been standardized:

$$X_1 = a_{11}F_1 + \cdots + a_{1m}F_m + e_1, \quad (1)$$

$$X_2 = a_{21}F_1 + \cdots + a_{2m}F_m + e_2, \quad (2)$$

$$\vdots$$

$$X_p = a_{p1}F_1 + \cdots + a_{pm}F_m + e_p. \quad (3)$$

The $(F_j)$ are the $(m)$ common factors, the $(e_i)$ are the $p$ specific errors, and the$(a_{ij})$ are the factor $p_{xM}$ factor loadings, The $Fj$ have mean zero and standard deviation one, and are generally assumed to be independent,(We will assume this orthogonality below, but it is not true for oblique rotations), the $ei$ are also independent and the $Fj$ and $ei$ are mutually independent of each other**[14].**

In matrix form this can be written as:

$$X_{(p,1)} = A_{(p,m)}\, F_{(m,1)} + e_{(p,1)}, \quad (4)$$

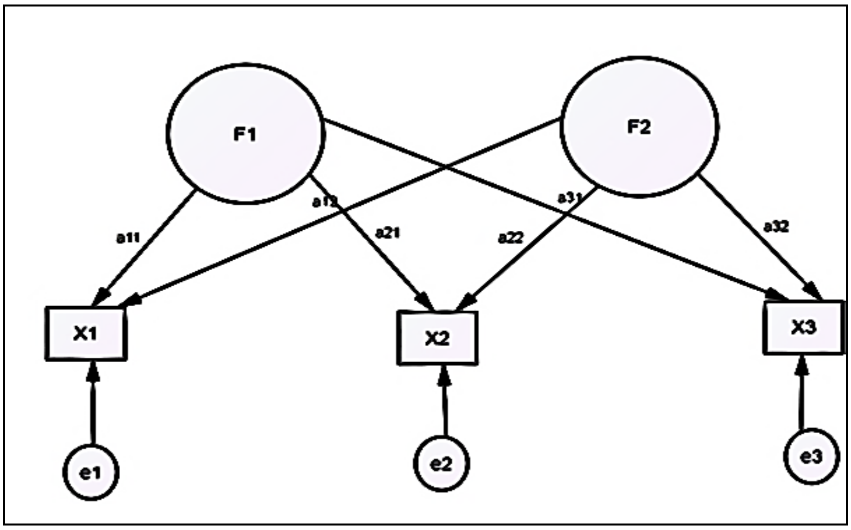
which is equivalent to

$$\Sigma = AA^T + cov(e). \quad (5)$$

where $\Sigma_{p\times p}$ is the correlation matrix of $X_{p\times 1}$, Since the errors are assumed to be independent, $cov(e)$ should be a $pxp$ diagonal matrix. This implies that:

$$Var(X_i) = \sum_{j=1}^{m} a_{ij}^2 + Var(e_i). \quad (6)$$

The sum of $X_i{}'s$ squared factor loadings is called its communality (the variance it has in common with the other variables through the common factors), The $i^{th}$ error variance is called the specificity of $X_i$ (the variance that is specific to variable $(i)$**[15]** note the diagram(1):




**Diagram(1) Factor Analytic models.**
**Source: by researcher.**

Factor Analytic models are often represented by path diagrams, each latent variable is represented by a circle, and each manifest variable is represented by a square, an arrow indicates causality… which can get to be a pretty complicated subject in some models**[16].**

## Canonical Discriminant Model:

Canonical correlations analysis uses a secondary set of multivariate observations to correlate with, and thereby help to explain, differences among a primary set of multivariate observations**[17]**.

Canonical discriminant analysis is a dimension-reduction technique related to principle component analysis and canonical correlation, it derives combinations of attributes to maximize the difference of the centroid of different classes (employment and non-employment years), in our case. A canonical discriminant function is a linear combination of the discriminating attributes. It has the following mathematical form:

$$f_{km} = u_0 + u_1 X_{1km} + u_2 X_{2km} + \dots + u_p X_{ikm}, \qquad (7)$$

Where $f_{km}$: the value (score) on the canonical discriminant function for case $(m)$ in the class $(k)$; $X_{ikm}$: the value on discriminant attribute $(X_i)$ for case $(m)$ in class $(k)$

And $u_i$: coefficients which produce the desired characteristics in the function**[18]**.

## Principal Component Analysis:

Principal components analysis is a data transformation technique. If, for a series of sites, or objects, or persons, a number of variables is measured, then each variable will have a variance (a measure of the dispersion of values around the mean), and usually the variables will be associated with each other, i.e. there will be covariance between pairs of variables. The data set as a whole will have a total variance which is the sum of the individual variances**[19].**

Generally, Principal components analysis (PCA) and factor analysis (FA) are statistical techniques applied to a single set of variables to discover which sets of variables in the set form coherent subsets that are relatively independent of one another, variables that are correlated with one another which are also largely independent of other subsets of variables are combined into factors, factors which are generated are thought to be representative of the underlying processes that have created the correlations among variables[20].

Now we try to explain the variance-covariance structure through a few linear combinations of the original $p$ variables $X1, X2, \dots, Xp$ (data reduction), let a random vector $X = (X1; X2; ::: ; Xp)^t$ have( p× p) population variance-

covariance matrix $var(X) = \Sigma$, denote the eigenvalues* of $\Sigma$ by $\lambda_1 \geq \lambda_2 \geq .. \geq \lambda_p \geq 0$,

consider the arbitrary linear combinations with fixed vectors $l_i$:

$$Y_1 = l_1^t X = l_{11}X_1 + l_{21}X_2 + \cdots + l_{p1}X_p \quad (8)$$

$$Y_1 = l_2^t X = l_{12}X_1 + l_{22}X_2 + \cdots + l_{p2}X_p \quad (9)$$

$$\vdots \qquad \vdots$$

$$Y_p = l_p^t X = l_{1p}X_1 + l_{2p}X_2 + \cdots + l_{pp}X_p \quad (10)$$

$$var(Y_i) = var(l_i^t X) = l_i^t \Sigma l_i \quad (11)$$

$$cov(Y_i, Y_k) = cov(l_i^t X, l_k^t X) = l_i^t \Sigma l_k \quad (12)$$

We define as principal components those linear combinations $Y1, Y2; \dots : ; Yp$,

which are uncorrelated and whose variances are as large as possible, since increasing the length of $l_i$ would also increase the variances, we restrict our search onto vectors $l_i$, which are of unit length, i.e. $\sum_j l_{ij}^2 = l_i^t \ l_i = 1$**[21].**

## Results and Discussion :

The sample set of the study covers the periods 2000–2004 and contains economic variables, and the ratios were obtained from Central Bureau of statistical of Syria**.**

### 1. The sample and variable selection

The original classification of the failed in employment policy and the non-employment years was made according to the year of number of employers was less than mean(4753322), and the employment years was made according to the year of number of employers was more than mean(4753322), table (1) presents the non- employment years, the employment years. Initially, the univariate analysis of variance

(ANOVA) test was applied to the 17 variables ratios of year1, and 17 variables were determined as the (FAMS)which have the discriminating ability for good and failed economic policy for employment.

**Table (1)Sample of the variables**

| year | Gross output(msp) | Agriculture(msp) | Mining & manufacturing(msp) | Building & construction(msp) | Wholesale & retail trade(msp) | Transport & communication(msp) |
|---|---|---|---|---|---|---|
| 2000 | 1557800 | 340570 | 611948 | 76777 | 159463 | 176202 |
| 2001 | 1650786 | 356006 | 614272 | 89781 | 182786 | 196258 |
| 2002 | 1697279 | 363724 | 615433 | 96282 | 194448 | 206285 |
| 2003 | 1743772 | 371442 | 616595 | 102784 | 206109 | 216313 |
| 2004 | 1862043 | 378378 | 695488 | 107190 | 232840 | 169245 |
| 2005 | 2010392 | 432713 | 723752 | 126668 | 275346 | 183944 |

* **Represents the amount of the original variance explained by each of the $k = 1$ to $p$ new derived variables.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 2006 | 2097883 | 398112 | 731012 | 142220 | 267884 | 198126 |
| 2007 | 2206821 | 373494 | 754497 | 145516 | 320126 | 220648 |
| 2008 | 2285909 | 371442 | 779571 | 134609 | 366047 | 247725 |
| 2009 | 2408994 | 394265 | 802733 | 140623 | 374531 | 247503 |

**Table (1) (continued)**

| year | Finance & insurance(msp) | Social & personal services(msp) | Government services(msp) | Total consumption(msp) | Gross Domestic Investment(msp) | Export of goods & services(msp) |
|---|---|---|---|---|---|---|
| 2000 | 35210 | 43111 | 113927 | 685683 | 156092 | 326715 |
| 2001 | 38413 | 47704 | 124891 | 731519 | 194018 | 317214 |
| 2002 | 40015 | 50000 | 130373 | 754436 | 212981 | 312463 |
| 2003 | 41616 | 52296 | 135855 | 777354 | 231944 | 307712 |
| 2004 | 46958 | 56683 | 159836 | 868570 | 255767 | 381123 |
| 2005 | 56057 | 65160 | 162858 | 966553 | 288193 | 375413 |
| 2006 | 63631 | 74282 | 163816 | 993163 | 308669 | 452612 |
| 2007 | 77468 | 82644 | 202464 | 1039221 | 283099 | 459003 |
| 2008 | 81704 | 92450 | 201501 | 1057211 | 266488 | 448622 |
| 2009 | 87037 | 100771 | 236148 | 1131091 | 297100 | 363474 |

**Table (1) (continued)**

| year | Import of goods & services(msp) | Consumption of fixed capital(msp) | Development Expenditures(msp) | Ordinary Expenditures(msp) | Budget allocated to education(msp) | employees(one) |
|---|---|---|---|---|---|---|
| 2000 | 263868 | 37502 | 132000 | 143400 | 18685 | 4319070 |
| 2001 | 281085 | 40139 | 161000 | 161000 | 44282 | 4821757 |
| 2002 | 289694 | 41457 | 184000 | 172389 | 53569 | 4474490 |
| 2003 | 298302 | 42775 | 211000 | 209000 | 69615 | 4339286 |
| 2004 | 418146 | 49651 | 217000 | 232500 | 68051 | 4693497 |
| 2005 | 526835 | 59973 | 180000 | 280000 | 74492 | 4929696 |
| 2006 | 459938 | 69668 | 195000 | 300000 | 91148 | 4945686 |
| 2007 | 511993 | 80416 | 258000 | 330000 | 98308 | 4956230 |
| 2008 | 524781 | 97504 | 230000 | 370000 | 112494 | 4999060 |
| 2009 | 469611 | 99499 | 275000 | 410000 | 129316 | 5054456 |

**Source:[22]**

Factor analysis will be used to look for a small number of economic dimensions. that adequately summarize the information contained in the original set of variables. This analysis is a class of multivariate statistical methods aimed at investigating the dimensions or constructs assumed to underlie a set of interdependent variables[**23**].

Table 2, present means and standard deviations of the financial ratios for the two groups (less than mean of employer's number(0)-( non-employment years) and more than mean of employer's number(1)-(employment years)):

**Table(2) test of equality of group means for the economic ratios**

| variables | non-employment years | | employment years | | Wilks' *Lambda | F | Sig. |
|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Mean | Std. Deviation | | | |
| Building & construction | 95758.3 | 13424.0 | 129902.8 | 20749.8 | .490 | 8.311 | .020 |
| Total consumption | 771510.8 | 75526.1 | 986459.7 | 137217.8 | .501 | 7.973 | .022 |
| Finance & insurance | 40949.8 | 4842.9 | 67385.0 | 18301.3 | .510 | 7.689 | .024 |
| Gross Output | 1715223.5 | 125797.6 | 2110130.8 | 264825.1 | .515 | 7.521 | .025 |
| Consumption of fixed capital | 42846.3 | 5059.7 | 74533.2 | 22821.9 | .527 | 7.191 | .028 |
| Mining & manufacturing | 634866.0 | 40462.9 | 734306.2 | 65832.0 | .528 | 7.143 | .028 |
| Social & personal services | 50522.5 | 5665.7 | 77168.5 | 19190.0 | .532 | 7.036 | .029 |
| Import of goods & services | 317502.5 | 68672.5 | 462373.8 | 93205.1 | .533 | 6.998 | .029 |
| Wholesale & retail trade | 198215.0 | 30425.4 | 297786.7 | 71653.5 | .545 | 6.691 | .032 |
| Ordinary Expenditures | 189322.3 | 39357.8 | 308500.0 | 86240.9 | .551 | 6.519 | .034 |
| Government services | 134997.8 | 19000.3 | 181946.3 | 39216.2 | .624 | 4.824 | .059 |
| Budget Allocated To Education | 52480.0 | 23659.8 | 91673.3 | 29785.6 | .624 | 4.82 | 0.06 |
| Gross Domestic Investment | 214196.0 | 42507.6 | 272927.8 | 41149.6 | .627 | 4.769 | .061 |
| Export of goods & services | 332003.3 | 33727.3 | 402723.0 | 58925.7 | .634 | 4.622 | .064 |
| Agriculture | 363528.5 | 16434.3 | 387672.0 | 27012.3 | .761 | 2.510 | .152 |
| Transport & communication | 192011.3 | 22822.1 | 215700.7 | 27410.9 | .798 | 2.026 | .192 |
| Development Expenditures | 186000.0 | 38755.6 | 216500.0 | 45169.7 | .868 | 1.214 | .303 |

**Source**: by researcher depending on table (1), by using SPSS17.

Significance tests for the equality of group means for each ratio, $F$ statistics and their observed significance levels are shown in the last two columns, in Table 1, variables are presented in ascending order, according to the significance level of $F$ statistics, the significant level is small (<5%) for the first 10 variables, hence, the null hypothesis that the two group means are equal is rejected at 5% significant level for these variables, the other variables displayed in Table 1 were excluded from the analysis, because of they were not able to split the years of study into the year that have number of employees less than mean and that have number of employees more than mean groups, equality of group means for these variables cannot be rejected at 5% significant level.

The other test statistics calculated in Table 1 is Wilks' lambda $\lambda$ which is the ratio of the within groups sum of squares to the total sum of squares, $\lambda$ teaks the value between 0 and 1 $0 \leq \lambda \leq 1$, $\lambda = 1$, means all observed group means equal.

Values close to 0 occur when within-groups variability is small compared to the total variability, that is, most of the total variability is attributable to differences between the means of the groups. As can be seen in Table 1, the groups' means of the first 10 variables are most different for employment and non-employment years.

## 2. Evaluating the appropriateness of factor analysis:

Evaluating the appropriateness of factor analysis means assessing whether the variables are significantly and sufficiently correlated with each other so that their number can be reduced by applying the factor analytic model. This can be done with a visual inspection of the correlation matrix for all variables, and by computing some statistics, including the Bartlett test of sphericity and the Keiser–Meyer–Olkin measure of sampling adequacy, the correlation matrix reveals that all but two variables have at least one

* **Wilks' lambda is a test statistic used in multivariate analysis of variance (MANOVA) to test whether there are differences between the means of identified groups of subjects on a combination of dependent variables.[24]**

correlation coefficient with an absolute value larger than 0.3, the value that Kinnear and Gray (1994) suggest as the minimum value for including a variable in the analysis**[25].**

Bartlett's test can be used to test the null hypothesis that the correlation matrix of the economic variables is an identity matrix, in other words, all of the diagonal l elements of the correlation matrix are equal to 1 and the rest of the elements are equal to 0 and any correlations do not exist between the variables:**[26]**

Table(3) presents the results of Bartlett's test of sphericity, the value of the chi-square test statistic for sphercity is large and observed significance level is small enough (<1% significant level), so the null hypothesis, can be rejected:

**Table(3) Results of Bartlett's test of sphericity**

| | | |
|---|---|---|
| *Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .513 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 433.043 |
| | df | 45 |
| | Sig. | .000 |

**Source: by researcher depending on table (1), by using SPSS17**.

***The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is an index used to examine the appropriateness of factor analysis. High values (between 0.5 and 1.0) indicate factor analysis is appropriate. Values below 0.5 imply that factor analysis may not be appropriate.[27]**

**Table (4), presents the correlation matrix of the ratios. Here, it can be seen that most of the variables shows correlation to each other:**

| variables | Gross output | Mining & manufacturing | Building & construction | Wholesale & retail trade | Finance & insurance | Social & personal services | Total consumption | Import of goods & services | Consumption of fixed capital | Ordinary Expenditures |
|---|---|---|---|---|---|---|---|---|---|---|
| Gross output | 1.000 | .980 | .942 | .988 | .987 | .988 | .994 | .884 | .977 | .996 |
| Mining & manufacturing | .980 | 1.000 | .915 | .968 | .962 | .958 | .987 | .925 | .955 | .975 |
| Building & construction | .942 | .915 | 1.000 | .895 | .908 | .895 | .958 | .907 | .872 | .925 |
| Wholesale & retail trade | .988 | .968 | .895 | 1.000 | .985 | .986 | .973 | .873 | .985 | .989 |
| Finance & insurance | .987 | .962 | .908 | .985 | 1.000 | .994 | .969 | .842 | .992 | .982 |
| Social & personal services | .988 | .958 | .895 | .986 | .994 | 1.000 | .967 | .819 | .995 | .989 |
| Total consumption | .994 | .987 | .958 | .973 | .969 | .967 | 1.000 | .920 | .953 | .988 |
| Import of goods & services | .884 | .925 | .907 | .873 | .842 | .819 | .920 | 1.000 | .821 | .872 |
| Consumption of fixed capital | .977 | .955 | .872 | .985 | .992 | .995 | .953 | .821 | 1.000 | .978 |
| Ordinary Expenditures | .996 | .975 | .925 | .989 | .982 | .989 | .988 | .872 | .978 | 1.000 |

**Source**: by researcher depending on table (1), by using SPSS17.

## 3. Applying PCA method:

In PCA, three-common factors were extracted, to decide how many factors needed to represent the economic data, percentages of total variances explained by each factor were estimated (eigenvalues).

Table(5), presents the estimated factors and their eigenvalues, in PCA, economic variables are expressed in standardized form, with a mean of 0 and the standard deviation of 1.

**Table(5)Eigenvalues of the factors**

| Component | Eigenvalues | % Variances | Cumulative % |
|---|---|---|---|
| F1 | 9.530 | 95.298 | 95.298 |
| F2 | .309 | 3.086 | 98.384 |
| F3 | .104 | 1.036 | 99.420 |
| F4 | .029 | .291 | 99.711 |
| F5 | .021 | .208 | 99.920 |
| F6 | .005 | .049 | 99.969 |
| F7 | .002 | .024 | 99.993 |
| F8 | .001 | .007 | 100.000 |
| F9 | .000 | .000 | 100.000 |
| F10 | .000 | .000 | 100.000 |

**Source**: by researcher depending on table (1), Applying FA Analysis by using SPSS17.

Ten economic variables were used in the study; then each ratio's standardized variance is 1 and the total variance is 10.

Only those factors that account for variances greater than 0.1 (eigenvalue >0.1) were included in the model. Factors with variance less than 0.1 are not better than a single variable, since each variable has a variance of 0.1

Hence, the first three factors were included in the model, factor (F1) is the most important dimension in explaining changes of economic conditions of employment. It explains 95.598% of the total variance of the economic variables. Factors F2 and F3, explain 3.086% and 1.063% of the total variance respectively. The estimated three common factor model explains 99.420% of the total changes of economic conditions for the number of employees.

The other objective of the PCA is to calculate factor scores for each of the studying year according to the three factors determined.

In PCA, all economic variables are standardized, with a mean of 0 $(\mu = 0)$and the standard deviation of 1$(\sigma = 1)$ according to Eq. (13);

$$Z_{ak} = \frac{g_k - \mu_k}{\sigma_k}, \qquad k = 1, \dots\dots\dots, 10, \qquad a = 1, \dots\dots\dots, 10 \qquad (13)$$

Where $g_k$: is a economic variable for the year $(k)$.

Estimated factors can be expressed as a function of the observed original variables (ratios). In order to estimate the $jth$ factor score $(Faj)$ for the year (a), Eq. (14) was used below:

$$F_{aj} = \sum_{k=1}^{m} w_{(j,k)} z_{ak}, \qquad j = 1,2,3, \qquad (14)$$

where, $w_{jk}$ is the factor score coefficient, for the $j_{th}$ factor and $k_{th}$ variable and $Z_{ak}$ is the standardized value of the $k_{th}$ variable for year $a$.

Table 6, presents the factor score coefficient matrix ($w_{(j,k)}$) estimated by PCA.

**Table(6) Factor score coefficients matrix ($w_{(j,k)}$)**

| Ordinary Expenditures | Consumption of fixed capital | Import of goods & services | Total consumption | Social & personal services | Finance & insurance | Wholesale & retail trade | Building & construction | Mining & manufacturing | Gross output | Factors |
|---|---|---|---|---|---|---|---|---|---|---|
| .196 | .538 | -.554 | -.101 | .420 | .333 | .370 | -.719 | .105 | .100 | F1 |
| -.141 | -.221 | 1.532 | .106 | -.448 | -.328 | .111 | -.367 | .590 | -.162 | F2 |
| .100 | -.496 | -.961 | .339 | .106 | .103 | -.658 | 2.355 | -.849 | .336 | F3 |

**Source**: by researcher depending on table (1), by using SPSS17.

To enhance the interpretability of the economic factors, the varimax factor rotation method was used in PCA. This method minimizes the number of variables that have high loadings on a factor.

Table 7, presents the factor loadings. Here, variables with large loadings for the same factors are grouped and small factor loadings (<0.5) are omitted**[28]**. Estimated factor represents a specific economic characteristic of the years under consideration.

**Table (7) Factor loadings***

| F3 | F2 | F1 | **economic variables** |
|---|---|---|---|
| | | .862 | Consumption of fixed capital |
| | | .849 | Social & personal services |
| | | .823 | Finance & insurance |
| | | .811 | Wholesale & retail trade |
| | | .784 | Ordinary Expenditures |
| | | .765 | Gross output |
| | | .718 | Mining & manufacturing |
| | | .698 | Total consumption |
| | .849 | | Import of goods & services |
| .609 | | | Building & construction |

**Source**: by researcher depending on table (1), by using SPSS17.

The first factor (F1) consists of the eight macro-economic variables (Consumption of fixed capital; Social & personal services; Finance & insurance; Wholesale & retail trade; Ordinary Expenditures; Gross output; Mining & manufacturing; and Total consumption). Hence, the first factor represents macro-economic employment policy. An increase in the score of the macro-economic variables factor have a positive value for a number of employers (employment) in that year, that is, the greater its value, the greater economic strengths for a employment years and lower for a non-employment years. All the variables grouped under this factor have positive loadings. Increase in the value of these variables will lead to increase in the score of the macro-economic employment policy factor.

The second factor (F2) consists of one external trade sector variable (Import of goods & services). The second factor represents the external trade structure within studied

* **It is deleted values that have loadings less than 0.40, by Spss17.**

years study. The increases in the score of the external trade factor have a positive value for a employment year; the greater its value, the greater employment for employment years.

The third factor (F3) consists of one variable (Building & construction), the value grouped under this factor have positive loadings. Any increase in the value of this variable will lead to increase in the score of Building & construction variable.

After determination of the basic economic factors for the study years, the FA Model were estimated according to these factors. The basic assumption of the estimation of factor models are based on that years can be split into two groups; the group of employment and the non-employment group. Thus, years can be represented by a dummy dependent variable $y_i$such that:

$$y_i = \begin{cases} 0, if\ the\ ith\ year\ non\ employment(number\ of\ employees\ less\ than\ mean), \\ 1, if\ the\ ith\ year\ employment(number\ of\ employees\ more\ than\ mean). \end{cases}$$

Factor analysis models are estimated according to the classification made on 2000 till 2009. The scores of three factors determined by the PCA were used as the independent variables in the estimation of the FA models, and predictive ability of the models was tested on the factor scores of ten years.

**Table(8) Standardized Canonical Discriminant Function Coefficients**

| Factors | Function |
|---|---|
| $F_1$ | 0.832 |
| $F_1$ | 0.177 |
| $F_1$ | 0.229 |

**Source**: by researcher depending on table (1), by using SPSS17

In table (8), the linear combination of the factors scores provide for each year a D-score, according to the estimated canonical discriminant model below:

$$D_a = 0.832F_1 + 0.177F_2 + 0.229F_3, \qquad (15)$$

Based on its D-score and the calculated cut-off score (C) in Eq. (16), a year is classified to the non-employment or the employment group. The optimum cut-off score is calculated approximately equal to zero, as the weighted average of the D-scores of the failed and the healthy year groups notice table(9):

$$C = \frac{N_A D_A + N_B D_B}{N_A + N_B} = \frac{6 * 1.265 + 4 * (-1.898)}{6 + 4} = 0.00002 \approx 0 \qquad (16)$$

Where

$C$: cut-off score

$N_A$: number of the employment years

$N_B$: number of the non-employment years

$D_A$: average score for employment years

$D_B$: average score for non-employment years

**Table(9) Functions at Group Centroids**

| Employment/non-employment years | **Function** |
|---|---|
| .00 | -1.898 |
| 1.00 | 1.265 |

**Source**: by researcher depending on table (1), by using SPSS17.

The classification is made by the following procedure:

if D-score > C, the year is classified to the employment group,

if D-score≤C, the year is classified to the non-employment group.

Table (10) shows the calculated D-scores and classification results for each of the year.

**Table 10 Estimated discriminant scores (Da) and classification results**

| Prediction | Da | Actual class | YEAR |
|---|---|---|---|
| 0 | -0.81424626 | 0 | 2000 |
| 0 | -0.67392546 | 1 | 2001 |
| 0 | -0.59922347 | 0 | 2002 |
| 0 | -0.4802876 | 0 | 2003 |
| 0 | -0.57482797 | 0 | 2004 |
| 0 | -0.45902631 | 1 | 2005 |
| 1 | 0.12042677 | 1 | 2006 |
| 1 | 0.56224982 | 1 | 2007 |
| 1 | 1.18981312 | 1 | 2008 |
| 1 | 1.72904736 | 1 | 2009 |

**Source**: by researcher depending on table (1), by using SPSS17.

This results show the predictive ability of the Da, the ability to differentiate between man power planning success years and troubled ones will help to reduce the expected rate of un employment.

On other hand table (9) shows that the accuracy equal to ((4*100)/4 = 100%) for predicting non-employment years, and equal to ((4*100)/6= 66.67%) for predicting employment years, that give an good indicator that helps decision makers in optimal manpower planning.

## Conclusions:

1. The factor analysis is important because it reduces a large number of variables into less factors that are the most important factors economic affecting the number of employers in Syria, and these variables are(Consumption of fixed capital; Social & personal services; Finance & insurance; Wholesale & retail trade; Ordinary Expenditures; Gross output; Mining & manufacturing; Total consumption; Import of goods & services; and Building & construction).

2. In this paper, the FAMS was constructed by using publicly open economic data. The system can be used as an analytical decision support tool for employment policies, and the ability to detect any problem in year condition from publicly available data will also reduce the cost of monitoring unemployment by lessening the need for on-site

examinations, and provide very valuable information to the decision makers as well as to the other interested parties and persons who are responsible from economic plans in Syria.

3. PCA results of this study show that complete employment criteria do not keep up one to one correspondence to the specific economic characteristics of study years in Syria.

4. research methodology proposed in this paper cannot be restricted to the employment sector alone. Further research could be conducted toward non-employment sectors to construct similar FAMS, as proposed in the paper. Combination of four parametric approaches(factor analysis, Principal Component Analysis, canonical analysis, regression analysis) may also give good results for the other business sectors for economic policy failure prediction.

5. Discriminant Analysis (DA) undertakes the same task as multiple linear regression by predicting an outcome in our research, the dependent is categorical(classification of years) with the predictor IV's at numerical level such as extraction factors.

## Recommendations:

1. The study recommends revealing the models that adopted by decision makers in employment sector, in order to guide those economic strategies, which are connected to effective models, such as FAMS. The results of the study referred that they have positive effect on succeeding employment plans scores.

2. The ten economic variables are Correlated with number of employers through this model: $D_a = 0.832F_1 + 0.177F_2 + 0.229F_3$, so it is necessary to show the importance of factor $F_1$that contains variables (Consumption of fixed capital; Social & personal services; Finance & insurance; Wholesale & retail trade; Ordinary Expenditures; Gross output; Mining & manufacturing; and Total consumption) while planning process.

3. The researcher recommends caring with the nature of years(non or employment years, so, employment plans should be divided into two groups, which provide the decision makers opportunity to highlight tools that they have to reduce un employment rate in long run .

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